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NEW HAVEN HARBOR. SHELLFISH RESOURCE AND WATER QUALITY

Federal Water Pollution Control Administration
Needham Heights, Massachusetts

August 1970

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SHELLFISH RESOURCE

AND

WATER QUALITY

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United States Department of the Interior
Federal Water Quality Administration
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New England Basins Office
Needham Heights, Massachusetts 02194

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SUMMARY

This report presents an evaluation of water quality in New Haven Harbor in 1967, an enumeration of waste discharges related to the problem and a detailed description of the shellfish resource in this area, including the subsequent effects of water quality to this resource.

Essentially, an examination of both bacteriological and biological water quality data indicate that water quality standards in the harbor area were not met at the time of the study. This conclusion is supported by data in terms of standards for coliform bacteria and sludge deposits and further, it appears that standards for dissolved oxygen, color and turbidity, taste and odor and chemical constituents were exceeded at least a portion of the time. The discharge of significant amounts of untreated and inadequately treated waste from both municipal and industrial sources in the harbor area undoubtedly accounts for the contravention of approved water quality standards. Although the data considered in this report was collected in 1967, current information indicates essentially that little, if any, pollution abatement has taken place in New Haven Harbor since the time of the study.

Implementation time schedules as a part of Connecticut water quality standards in New Haven Harbor, as approved by the Secretary of the Interior, require initiation of secondary treatment facilities to upgrade present primary treatment plants at the Boulevard, East Shore and East Street plant locations, all of which are operated by the City of New Haven. The dates in these Federally approved standards

require initiation of construction by November 1970, and initiation of secondary operation by November 1972. The State of Connecticut Water Resources Commission has indicated, however, that these dates have been delayed by about one year in terms of start of construction and two years with regard to operation of new improved facilities. The industrial waste discharges, in general, appear to follow the same pattern of delay as the municipal plants.

The report develops a detailed historical background and an understanding of controls regulating the shellfish industry. It also relates the loss of shellfish acreage as a result of sludge deposits and the closing of all shellfish beds in the Inner Harbor for commercial harvest purposes due to waste contamination, particularly coliform bacteria. Those beds remaining in the Inner Harbor can only be used for cultivation and the shellfish must be transplanted to open beds in the ocean for commercial harvesting.

Both observations during the study and a brief examination of limited tidal and current data appear to support the contention that minimal scour of the bottom occurs in portions of the Inner Harbor. As a result, extensive sludge deposition has taken place. It would appear that after adequate waste treatment facilities are in operation, consideration will have to be given regarding removal and ultimate disposal of these deposits.

INTRODUCTION

New Haven Harbor is a relatively shallow estuary located in Connecticut on the northern shore of Long Island Sound. It is in the southern part of the state, 79 miles northeast of New York, New York and 140 miles southwest of Boston, Massachusetts. The harbor is divided into inner and outer portions by a line extending between Sandy Point and Fort Hale Point. The Inner Harbor area is approximately 2.5 square miles and the Outer Harbor encompasses approximately 8.3 square miles. A dredged channel which forms the entrance to the harbor is approximately 34 feet deep at the entrance, decreasing to 16 feet at the Ferry Street bridge in the Quinnipiac River. The mean depth at mean low tide for the entire harbor is 11.5 feet.

New Haven is the largest city in the east Connecticut coastal basin with considerable industry in or near the city. There are over 400 separate manufacturing plants ranging from minor operations to firms employing several thousand people. Predominant types of industry include metal fabricating and plating, chemicals, paper board and boxes and textile finishing. The Inner Harbor is surrounded on three sides by industrial docking facilities, the majority of which are devoted to the transfer and storage of petroleum products. A modern deep water cargo handling facility is located on the east shore.

There are in excess of 200 miles of sewer mains serving the municipality. Three New Haven water pollution control facilities, the East Street plant, the Boulevard plant and the East Shore plant, discharge their effluents to the Inner Harbor. These facilities also

treat the wastewater from the towns of Hamden and East Haven. The West Haven water pollution control plant discharges to the Outer Harbor. The effluent from the North Haven water pollution control plant is discharged to the Quinnipiac River. At the time of the study, all plants provided primary treatment with the exception of North Haven which had secondary treatment.

Information on those industries and municipalities contributing wastes either directly or indirectly to the harbor area from New Haven and surrounding communities is shown in Table 1 in Appendix A. The location of these sources is indicated in Figure 1 at the end of the report. In Appendix B a comparison of present water quality with approved water quality standards on the basis of classifications is shown in Table 2. The parameters and criteria assigned to various classifications for the State of Connecticut are also included in this section. Finally, Appendix B contains the present status of implementation schedules for pollution abatement for New Haven and West Haven. In Appendix C Figures 2 and 3 contain information concerning current patterns in the Inner Harbor.

The objective of this study was to determine the microbiological and biological quality of the waters of New Haven Harbor with particular regard to the valuable shellfish resource in this area.

WATER QUALITY*

General

In order to obtain indications of water quality in the New Haven area, a series of sampling stations were chosen in the Outer Harbor, the Inner Harbor, West River, Mill River and Quinnipiac River. Basically, parameters included coliform bacteria, temperature and conductivity. In addition a biological study was conducted to ascertain general bottom conditions and the type of benthic organisms encountered. The field work was undertaken by personnel of the New England Basins Office, Northeast Region, Federal Water Quality Administration, during the periods September 6-15 and October 9-16, 1967. All samples, with the exception of those obtained in conjunction with shellfish or biological studies, were collected either at high water and/or low water slack. A discussion of analytical procedures and methods utilized in these studies is provided in succeeding sections. Water quality sampling station locations are shown on Figure 4 and further identified in Table 3. Locations and data relative to shellfish sampling are presented under Shellfish Resource.

Microbiology

Values of total and fecal coliform densities were used as indicators of bacterial pollution of New Haven Harbor.

The analytical method used to enumerate the coliform densities was the multiple fermentation tube technique using decimal dilution of five tubes per dilution. This test is also known as the Most Probable

*All tables and figures follow page 10.

Number (MPN) method as it is based upon a statistical estimation of bacterial density. All techniques were in accordance with "Standard Methods for the Examination of Water and Wastewater - 12th Edition."

During the first sampling period, September 6-15, 1967, the city of New Haven was chlorinating its water pollution control plant effluent. There was no chlorination of wastewater during the second sampling period from October 10-15, 1967. Tables 4 and 5 present a summary of the results obtained during the September and October studies, while Table 6 indicates the geometric mean total coliform values.

The data, as compared to actual fecal coliform values, show the effect of chlorination of water pollution control plant effluents on the harbor waters. During the period when disinfection was being practiced, total coliform values in the harbor water ranged from 6000 to 100 MPN and fecal coliform ranged from 1500 to 20. During the period when disinfection of the plant's wastes was not practiced, the total coliform densities ranged from 150,000 to 200 MPN, and fecal coliform values ranged from 25,000 to 100 MPN.

The maps showing approximate surface water sample total and fecal coliform densities as isometric lines during both sampling periods (Figures 5 through 16) illustrate the considerable effect chlorination of the four primary plant effluents has on the water quality classification that can be attained in New Haven Harbor. The summary for all tides (Figures 5, 8, 11 and 14) includes data obtained at ebb and flood tides. It indicates the type of results that might be obtained

from a composite sampling program. It does not represent an actual point situation in the environment except on a relative magnitude basis in a comparison between different periods or areas.

As would be expected, coliform concentrations are highest in the Inner Harbor and in those areas receiving low flushing velocities as shown in the current charts (Figures 2 and 3). Data obtained in the vicinity of the water pollution control plant outfalls demonstrate their effect on the overall harbor water quality, particularly when a comparison is made between the periods of effluent chlorination and non-chlorination. Further comparison between high and low tide values in relation to the current studies, provides an interesting basis for a look at the overall nature of the harbor problem.

Analysis of the water samples for September, taken in the vicinity of shellfish sampling areas 1 through 4 (Figure 27), shows a direct relationship in magnitude to the shellfish meat coliform data presented later. The ability of the oyster to concentrate contaminants in their consumable meat fraction is well demonstrated.

Table 6 presents a comparison between the geometric mean total coliform value and the stated fecal coliform value. A comparison of the values shown indicates that the fecal pollution at station groupings 11 through 17, and 18 through 24, was in all probability of a recent nature.

Temperature and Conductivity Data

Temperature and conductivity data for both sampling periods are presented in Tables 7 through 9. A visual comparison of surface water

sample conductivity data is presented in Figures 17 and 18. Results obtained are as expected, the freshwater influence being noted in the Inner Harbor with a gradual increase in salinity proceeding out to Long Island Sound. The character of the currents as shown in Figures 2 and 3 is further demonstrated here. Conductivity data is reported only for the period of September 6 through 10 due to a malfunction in the salinometer probe. Variations in temperature are presented in Tables 8 and 9 and visually for surface water in Figures 19-22.

Profiles were taken from east to west across the harbor on September 7 and 8, 1967. Station locations are shown in Figure 23 and the temperature and conductivity data obtained are presented in Tables 10, 11, 12 and 13. All in-situ measurements were taken during flood tide and depth figures given are not corrected to mean low water.

There were no marked variations in temperature or conductivity, either with depth at each profile location or between locations. In almost all cases the surface temperatures and conductivities were higher than those near the bottom. The range of values across each of the four profiles is as follows:

Profile	Temp. Range °C	Conductivity Range millimhos/cm
Harbor side of breakwaters	19.4 - 20.6	35.1 - 35.8
Morgan Pt. to Oyster River Pt.	19.6 - 20.8	35.4 - 36.3
Forbes Bluff to Old Field Crk.	20.0 - 21.9	35.2 - 35.9
Ft. Hale Pt. to Sandy Pt.	20.0 - 22.0	35.1 - 36.0

There are insufficient data available to make any definitive conclusions. Further cross sectional studies proceeding into the Inner Harbor on both flood and ebb tides would be required.

Biology

A biological survey of New Haven Harbor was conducted during the periods September 11-22 and October 9-16, 1967 to investigate the overall quality of the harbor as revealed by the benthic community and general bottom conditions. Two major tributaries to the Harbor, the Mill and Quinnipiac Rivers, were also sampled in addition to reference stations outside of the breakwaters in Long Island Sound (see Figure 24 and Tables 14 and 15).

Immediately below Whitney Lake at Station 1, the Mill River was a clear, fast moving stream about ten feet wide and one to two feet in depth. The bottom was composed mainly of rock and coarse sand with no evidence of siltation. Benthic organisms found included caddis larvae, water fleas, hydrae, snipe flies, ostracods and clams (see Table 16). Occasional patches of rooted aquatic plants were present, and large schools of small eels and minnows were grazing in the area. The number and kinds of benthic organisms found, in addition to physical conditions, indicate good water quality at this station.

At Stations 2, 3 and 4 on the Mill River, the river bed was covered by more than six inches of decomposing sludge. Benthic life was completely absent, indicating severe toxicity caused by deoxygenation of the environment and the production of toxic by-products by the decomposing sludge. This section of the Mill River is tidal,

thus pollutants discharged from industries downstream can be carried upriver on flood tide and may affect these areas. The absence of benthic life in conjunction with the degraded physical environment at Stations 2, 3 and 4 indicate that this portion of the Mill River is grossly polluted.

A total of five biological stations were established and sampled in the Quinnipiac River (see Table 14 and Figure 24). Bottom samples from Stations 5-8 contained a majority of polychaete worms, crabs and barnacles. Sludge depths overlying a fine sand bottom ranged from two to five inches, and some evidence of decomposition was noted. A noticeable increase in kinds of benthic organisms was evident at the downstream stations 7 and 8 (Figure 25). These data indicate that the Quinnipiac River is of intermediate water quality at Stations 5-8.

Station 9 in the Quinnipiac River could not be sampled due to a layer of oyster shells covering the bottom sediments. This area is used by the Mansfield Oyster Company as a setting bed, making it impossible for the dredge to obtain a sample of the mud below the shells. Benthic life was completely absent at Station 10 in the Quinnipiac River. Two to five inches of sludge covered the bottom, and strong odors of decomposition were apparent during sampling. This station is affected by residual water from the Mill River on incoming tide which may contribute to the grossly polluted conditions observed.

Station 11 was located 30 feet from the east bank of the harbor just below the confluence of the Mill and Quinnipiac Rivers. Because of its location, this station is influenced by harbor water on incoming tide and Quinnipiac River water on outgoing tide. The effect

of the Mill River on this station is minimal. Many polychaete worms (20,554 per square meter), as shown in Table 16, were present in conjunction with scuds, mud crabs, clams barnacles and snails. The high numbers of polychaete worms indicate excessive organic enrichment at this station, resulting in a polluted condition.

In general, the portion of the Inner Harbor from the confluence of the Mill and Quinnipiac Rivers to City Point (Stations 12-15) showed evidence of gross pollution. Sludge depths exceeded six inches at these stations (see Figure 26), and benthic populations were absent or represented by minimal numbers of polychaete worms and snails. Quantities of oil were observed in all bottom samples from this area, and decomposition odors were prevalent.

The substrate at Station 16 on the east shore of the Inner Harbor was composed of gravel, sand and rock, and supported 15 kinds of benthic organisms. No evidence of sludge deposition was noted at this station.

An examination of the remainder of the Inner Harbor (Stations 17-20) revealed that two to five inches of sludge covers the bottom and this area appeared to support only minimal numbers of polychaete worms, snails and bivalves. This portion of the harbor is polluted.

In the Outer Harbor at Stations 22, 28, 29, 31 and 32 two to five inches of sludge covered the bottom. Four to six kinds of benthic life inhabited these areas, indicating some recovery of the benthic conditions from those found in the Inner Harbor.

In Morris Cove at Station 21, one half to one inch of sludge covered the bottom. Here limpet snails, mysid shrimp, crabs, clams and polychaetes were present, indicating improved biological conditions. Apparently, the strong current running through the cove of 0.70 knots on ebb tide (Figure 3) is sufficient to flush most of the solids through this area. From Morris Cove to the east breakwater at the harbor entrance, a clean water benthic population existed.

Sludge deposition was not found behind the breakwater at Sandy Point or along the west shore of the Outer Harbor (see Figure 26). An examination of the bottom indicated gravel, sand and shells that support 11 to 18 kinds of life (Stations 23, 24, 26 and 30), and is indicative of good water quality.

In the main channel of the harbor at the breakwaters (Station 35) the bottom was composed of sand, gravel and rock which supported a variety of life, including mysid shrimp, limpet snails, clams and polychaete worms.

On the Long Island Sound side of the breakwater at Stations 37-39, a great variety of organisms were present, indicating a clean environment (see Table 16). Included in the benthic population at these stations were moss animals (Ectoprocta) starfish (Asterias sp.), hydroids (Podocoryne carnea) and (Bougainvillia carolinensis), copepods, mysid shrimp, scuds, sowbugs, crabs, snails and small numbers of polychaete worms. Twenty-five kinds of organisms were present at Station 39, dominated by the clam Nucula proxima.

TABLE 3

WATER QUALITY SAMPLING STATIONS

NEW HAVEN HARBOR

STATION #	RIVER NAME	RIVER MILES*
1	Quinnipiac River	9.18**
2	Quinnipiac River	1.26
3	Mill River	6.54**
4	Mill River	1.24
5	West River	1.88

	LATITUDE	LONGITUDE
9	41° 16' 46"	72° 54' 46"
12	41 15 47	72 54 48
13	41 14 45	72 54 56
14	41 14 52	72 55 44
15	41 14 40	72 56 02
16	41 14 26	72 54 35
17	41 14 12	72 57 43
18	41 13 21	72 56 22
19	41 14 17	72 53 39
20	41 13 18	72 54 35
21	41 14 02	72 55 02
22	41 12 58	72 57 06
23	41 12 55	72 55 47
24	41 13 52	72 53 07

* #1-5 Readings from 1954 USGS New Haven and Vicinity Quadrangle
Miles measured from mouth of river.

** Not shown in Figure 5, upstream from the area depicted.

TABLE 4

COLIFORM VALUES - NEW HAVEN HARBOR

SEPTEMBER 6-15, 1967							OCTOBER 10-15, 1967						
STATION	AVG. TOTAL COLIFORMS MPN/100 ML			AVG. FECAL COLIFORMS MPN/100 ML			STATION	AVG. TOTAL COLIFORMS MPN/100 ML			AVG. FECAL COLIFORMS MPN/100 ML		
	LOW TIDE	OVER-ALL*	HIGH TIDE	LOW TIDE	OVER-ALL*	HIGH TIDE		LOW TIDE	OVER-ALL*	HIGH TIDE	LOW TIDE	OVER-ALL*	HIGH TIDE
1 S	33,600	53,633	63,650	23,900	15,600	11,450							
2 S	6,633	13,487	20,340	563	1,670	2,777	2 S	13,000	67,050	85,067	200	11,525	15,300
3 S	1,355	1,478	1,600	640	695	750							
4 S	477,400	331,200	185,000	89,950	55,225	20,500							
5 S	2,050	6,575	11,100	265	528	790							
9 S	5,163	4,280	4,315	1,810	1,399	1,302	9 S	151,975	89,411	39,360	28,625	17,289	8,220
B	-	230	230	-	80	80	B	-	13,000	13,000	-	800	800
12 S	6,366	4,111	740	679	552	191	12 S	75,800	83,933	90,440	15,550	11,747	8,704
B	-	130	130	-	20	20							
13 S	90	73	65	50	30	20	13 S	91,775	61,336	30,898	4,995	3,852	2,710
14 S	3,680	2,964	74	1,003	1,707	30							
15 S	2,972	1,576	20	1,575	775	20	15 S	6,087	3,446	1,465	1,243	657	218
B	80	40	20	20	20	20							
16 S	1,24-	1,297	117	145	138	23	16 S	5,420	4,187	3,570	1,300	760	490
B	40	67	80	20	20	20							
17 S	24	46	72	20	26	34	17 S	50	476	795	30	214	352
18 S	60	245	110	23	41	30	18 S	140	630	875	65	143	182
B	-	20	20	-	20	20							
19 S	72	64	65	20	24	30	19 S	1,822	3,708	5,216	372	456	522
20 S	244	112	20	59	36	20	20 S	2,498	1,243	240	195	113	48
21 S	80	50	35	40	27	20	21 S	5,080	3,914	2,982	2,560	1,346	374
22 S	20	50	65	20	20	20	22 S	35	77	133	20	29	40
							B	-	700	700	-	90	90
23 S	20	20	20	20	20	20	23 S	190	148	128	35	25	20
							B	-	20	20	-	20	20
24 S	20	20	20	20	20	20							

*Includes values of surface coliforms at ebb and flood tides
S - Surface water sample
B - Bottom water sample

TABLE 5

MAXIMUM COLIFORM VALUES

NEW HAVEN HARBOR

STATION	TOTAL COLIFORMS MPN/100 ML		FECAL COLIFORMS MPN/100 ML	
	SEPT.	OCT.	SEPT.	OCT.
2 S	54,200	109,000	7,900	24,000
9 S	13,000	348,000	7,900	92,000
9 B	-	-	-	-
12 S	17,200	348,000	1,700	33,000
13 S	-	172,000	-	10,900
14 S	> 16,000	-	>16,000	-
15 S	16,000	16,000	9,200	3,480
16 S	9,200	5,420	700	1,300
17 S	220	1,410	80	790
18 S	2,400	2,400	230	330
19 S	230	16,000	80	1,720
20 S	490	9,200	170	490
21 S	80	16,000	40	9,200
22 S	80	330	20	80
22 B	-	-	-	-
23 S	20	20	20	50
23 B	-	-	-	-
24 S	20	-	20	-

S - Surface water sample
B - Bottom water sample

TABLE 6

GEOMETRIC MEAN TOTAL COLIFORM VALUE
FOR STATED FECAL COLIFORM VALUE

SEPTEMBER 6-15, 1969

FECAL MPN/100 ML	STATION GROUPS*			
	1 - 5	9	12 - 17	18 - 24
< 20	--	--	33	31
20	--	--	43	50
40	--	--	70	117
200	1240	1300	700	--

*Stations 1 - 5 River
" 9 Inner Harbor
" 12 - 17 Outer Harbor
" 18 - 24 At or outside of Breakwater

TABLE 7

CONDUCTIVITY VALUES

NEW HAVEN HARBOR

STATION	SEPTEMBER 6-10, 1967 AVERAGE CONDUCTIVITY MILLIMHOS/CM		
	HIGH TIDE	OVERALL	LOW TIDE
2	33.4	-	20.6
9 S	35.5	35.0	34.5
9 B	35.3	-	-
12 S	36.0	35.3	34.8
12 B	35.7	-	-
14	36.3	35.9	35.6
15	36.3	35.7	35.1
16 S	36.3	35.8	35.5
16 B	36.1	-	35.9
17	36.1	35.9	35.7
18 S	36.0	35.6	35.2
18 B	35.3	-	-
19	36.1	36.0	35.9
20	36.6	36.2	35.8

S - Surface water sample
B - Bottom water sample

TABLE 8

TEMPERATURE VALUES
NEW HAVEN HARBOR

SEPTEMBER 6-15, 1967

STATION	TEMPERATURE °C					
	HIGH TIDE			LOW TIDE		
	MAX.	AVG.	MIN.	MAX.	AVG.	MIN.
1	22.9	21.5	19.3	20.5	20.2	20.0
2	21.3	20.5	19.8	21.3	20.0	19.2
3	17.2	15.7	14.2	16.0	15.8	15.6
4	20.6	20.3	20.0	21.7	21.5	21.3
5	19.3	19.2	19.0	22.0	21.7	21.4
9 B	-	20.4	-	-	20.4	-
9 S	21.9	20.0	18.7	21.7	-	19.2
12 S	21.5	20.2	18.7	21.2	20.2	19.3
12 B	-	-	-	-	-	-
13	18.8	18.8	18.8	-	19.4	-
14	21.5	20.6	19.7	21.1	20.0	19.1
15 S	21.7	20.6	19.7	-	-	-
15 B	20.4	20.3	20.2	24.0	20.4	18.0
16 S	21.7	20.6	19.5	25.2	21.0	19.2
16 B	-	20.5	-	-	20.4	-
17	21.1	19.9	18.7	20.3	19.7	19.2
18 S	20.9	20.3	19.3	20.5	19.9	19.3
18 B	-	19.5	-	-	-	-
19	21.0	20.4	19.5	20.5	19.9	19.1
20	21.5	20.0	18.8	20.7	19.9	19.1
21	18.9	18.8	18.8	-	19.3	-
22	18.9	18.8	18.6	-	19.6	-
23	18.8	18.8	18.7	-	19.4	-
24	18.9	18.8	18.8	-	19.4	-

S - Surface water sample
B - Bottom water sample

TABLE 9

TEMPERATURE VALUES
NEW HAVEN HARBOR

OCTOBER 10-15, 1967

STATION	TEMPERATURE °C					
	HIGH TIDE			LOW TIDE		
	MAX.	AVG.	MIN.	MAX.	AVG.	MIN.
2	18.0	17.1	16.5	-	16.5	-
9 S	17.5	16.3	15.5	17.5	16.7	16.0
9 B	-	-	-	-	-	-
12	17.0	16.0	15.0	17.5	16.3	15.5
13	17.0	16.2	15.5	17.5	16.2	15.5
15	16.5	16.1	15.5	17.0	15.8	15.0
16	16.5	16.3	16.0	-	16.0	-
17	16.5	16.0	15.5	17.0	16.1	15.5
18	17.0	16.2	15.5	16.5	16.0	15.5
19	17.0	16.1	15.5	16.5	16.1	15.5
20	17.0	16.3	15.5	17.0	16.2	15.5
21	17.0	16.2	15.5	17.0	16.5	15.5
22 S	16.5	16.2	16.0	17.0	16.3	16.0
22 B	-	-	-	-	-	-
23 S	16.5	16.1	16.0	16.5	16.0	15.5
23 B	-	-	-	-	-	-

S - Surface water sample
B - Bottom water sample

TABLE 10

PROFILE - HARBORSIDE OF BREAKWATERS
NEW HAVEN HARBOR
9/7/67 FLOOD TIDE

STATION #	DEPTH (ft.)	TEMP. (°C)	CONDUCTIVITY (millimhos/cm)
A	4	20.1	35.7
	3	20.1	35.7
	2	20.1	35.7
	1	20.0	35.6
	Surface	20.1	35.6
B	15	19.9	35.7
	12	19.9	35.7
	9	19.9	35.6
	6	19.9	35.7
	3	20.1	35.7
	Surface	20.3	35.7
C	14	19.8	35.8
	10	19.9	35.8
	6	20.2	35.8
	3	20.1	35.6
	Surface	20.1	35.6
D	14	20.0	35.3
	10	20.1	35.2
	6	20.1	35.2
	3	20.1	35.2
	Surface	20.6	35.2
E	26	19.8	35.3
	19	19.9	35.3
	13	19.9	35.3
	7	20.0	35.3
	Surface	20.1	35.1
F	40	19.4	35.6
	30	19.5	35.6
	20	19.6	35.7
	10	19.7	35.6
	Surface	19.9	35.7
G	20	19.8	35.4
	15	19.9	35.4
	10	19.9	35.4
	5	19.9	35.4
	Surface	20.1	35.4

TABLE 10 (Continued)

STATION #	DEPTH (ft.)	TEMP. (°C)	CONDUCTIVITY (millimhos/cm)
H	18	19.5	35.2
	14	19.9	35.2
	9	19.8	35.2
	4	19.8	35.2
	Surface	20.2	35.4
I	25	19.6	35.2
	19	19.8	35.1
	13	19.5	35.1
	6	19.7	35.1
	Surface	20.3	35.5
J	28	19.8	35.3
	21	19.6	35.3
	14	19.7	35.1
	7	19.9	35.1
	Surface	20.4	35.5
K	35	19.5	35.4
	27	19.8	35.3
	19	19.5	35.4
	12	20.0	35.4
	Surface	20.1	35.6
L	33	19.7	35.3
	25	19.9	35.3
	17	19.7	35.4
	9	19.8	35.3
	Surface	19.9	35.3
M	26	20.1	35.5
	20	19.9	35.5
	12	19.7	35.5
	6	20.0	35.5
	Surface	20.6	35.4
N	24	19.9	35.5
	18	19.8	35.5
	12	19.7	35.5
	6	19.8	35.7
	Surface	20.2	35.8
O	24	19.7	35.4
	18	19.8	35.4
	12	19.6	35.3
	6	19.7	35.3
	Surface	20.3	35.8
P	20	19.7	35.4
	15	19.7	35.4
	10	19.8	35.4
	5	20.0	35.6
	Surface	20.5	36.0

TABLE 11

PROFILE - MORGAN POINT TO OYSTER RIVER POINT
NEW HAVEN HARBOR
9/8/67 FLOOD TIDE

STATION #	DEPTH (ft.)	TEMP. (°C)	CONDUCTIVITY (millimhos/cm)
A1	20	19.7	35.4
	15	19.8	35.5
	10	19.9	35.5
	5	19.9	35.6
	Surface	20.2	35.7
B1	20	19.8	35.5
	15	19.6	35.5
	10	19.8	35.4
	5	20.0	35.3
	Surface	20.5	35.7
C1	11	20.3	35.6
	5	20.5	35.7
	Surface	20.4	35.6
D1	16	20.4	35.7
	12	20.3	35.7
	8	20.2	35.7
	4	20.1	35.7
	Surface	20.2	35.7
E1	44	20.1	35.6
	30	20.0	35.6
	20	20.1	35.6
	10	20.1	35.6
	Surface	20.2	35.6
F1	15	20.1	35.6
	10	20.1	35.6
	5	20.2	35.6
	Surface	20.8	36.0
G1	15	20.1	36.1
	12	20.3	36.1
	10	20.3	36.1
	7.5	20.3	36.1
	5	20.3	36.1
	2.5	20.3	36.1
	Surface	20.5	36.3

TABLE 12

PROFILE - FORBES BLUFF TO OLD FIELD CREEK
NEW HAVEN HARBOR
9/8/67 FLOOD TIDE

STATION #	DEPTH (ft.)	TEMP. (°C)	CONDUCTIVITY (millimhos/cm)
A2	4	21.1	35.7
	2	21.2	35.6
	Surface	21.4	35.5
B2	7	20.7	35.5
	5	20.9	35.5
	2	20.9	35.6
	Surface	21.2	35.6
C2	43	19.9	35.4
	30	20.0	35.4
	20	20.1	35.4
	10	20.1	35.2
	Surface	20.2	35.4
D2	10	20.5	35.7
	7.5	20.3	35.7
	5	20.5	35.8
	2.5	20.6	35.8
	Surface	20.7	35.8
E2	15	20.2	35.5
	12	20.2	35.6
	9	20.3	35.4
	6	20.9	35.5
	3	21.4	35.7
	Surface	21.9	35.9

TABLE 13

PROFILE - FORT HALE POINT TO SANDY POINT
NEW HAVEN HARBOR
9/8/67 FLOOD TIDE

STATION #	DEPTH (ft.)	TEMP. (°C)	CONDUCTIVITY (millimhos/cm)
A3	8	20.3	35.2
	6	20.1	35.3
	4	20.5	35.2
	2	20.3	35.1
	Surface	22.0	35.9
B3	40	20.0	35.4
	30	20.1	35.4
	20	20.3	35.4
	10	20.5	35.5
	Surface	21.0	35.7
C3	6	20.9	35.6
	3	21.4	36.0
	Surface	21.5	35.7

TABLE 14

BIOLOGICAL SAMPLING STATIONS

NEW HAVEN HARBOR TRIBUTARIES

1967

		River Miles*
1.	Mill River - 100' below dam on Whitney Lake	- 1.9 miles
2.	Mill River - 100' above Willow St. Bridge	- 1.3 miles* (4)
3.	Mill River - 100' below Route 5 Bridge	- 1.1 miles
4.	Mill River - East Fork - South End of Island	- 0.4 miles
5.	Quinnipiac River - 100' above R.R. Bridge	- 2.4 miles
6.	Quinnipiac River - East Channel above R.R. Bridge	- 1.8 miles
7.	Quinnipiac River - opposite Chatham St. (west side)	- 1.4 miles
8.	Quinnipiac River - opposite Chatham St. (east side)	- 1.4 miles
9.	Quinnipiac River - 100' above Mansfield Oyster Co.	- 1.3 miles* (2)
10.	Quinnipiac River - 100' above Ferry St. Bridge	- 0.6 miles

*Miles measured from the confluence of Mill and Quinnipiac Rivers

Number in parenthesis indicates nearest corresponding water quality station.

TABLE 15

BIOLOGICAL SAMPLING STATIONS
NEW HAVEN HARBOR*

STATION	LATITUDE	LONGITUDE	
11 Inner Harbor	41°17'52"	72°54'17"	
12 Inner Harbor	41 17 39	72 54 25	
13 Inner Harbor	41 17 40	72 54 48	
14 Inner Harbor	41 17 26	72 54 38	
15 Inner Harbor	41 16 55	72 54 59	
16 Inner Harbor	41 16 46	72 54 29	
17 Inner Harbor	41 16 47	72 54 46*	(9)
18 Inner Harbor	41 16 46	72 55 26	
19 Inner Harbor	41 16 28	72 55 39	
20 Inner Harbor	41 16 18	72 54 44	
21 Outer Harbor	41 15 44	72 54 07	
22 Outer Harbor	41 15 46	72 54 47*	(12)
23 Outer Harbor	41 15 43	72 55 11	
24 Outer Harbor	41 15 08	72 55 44	
25 Outer Harbor	41 14 54	72 56 41	
26 Outer Harbor	41 14 52	72 57 35	
27 Outer Harbor	41 14 26	72 54 35*	(16)
28 Outer Harbor	41 14 40	72 56 02	
29 Outer Harbor	41 14 12	72 57 43*	(17)
30 Outer Harbor	41 14 01	72 58 34	
31 Outer Harbor	41 13 14	72 58 00	
32 Long Island Sound	41 13 18	72 57 03	
33 Outer Harbor	41 13 21	72 56 22*	(18)
34 Long Island Sound	41 13 35	72 55 44	
35 Outer Harbor	41 14 02	72 55 02*	(21)
36 Long Island Sound	41 14 09	72 54 19	
37 Long Island Sound	41 14 17	72 53 39*	(19)
38 Long Island Sound	41 13 52	72 53 07*	(24)
39 Long Island Sound	41 12 09	72 53 49	

*Number in parenthesis indicates nearest corresponding water quality station.

TABLE 16
BENTHIC ORGANISMS
NEW HAVEN HARBOR AND TRIBUTARIES
SEPTEMBER 1967

(NUMBERS PER SQUARE METER)

STATION NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13
Marine Worms (Polychaeta)													
Paraonidae	-	-	-	-	-	-	-	-	-	-	-	-	-
Terebellidae	-	-	-	-	-	-	-	-	-	-	-	-	-
Cystenides gouldii	-	-	-	-	-	-	-	-	-	-	-	-	-
Lumbrineris sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigalionidae	-	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys incisa	-	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys caeca	-	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys picta	-	-	-	-	-	-	-	Q	-	-	140	-	-
Arabella iricolor	-	-	-	-	-	-	-	-	-	-	-	-	-
Phyllodoce groenlandica	-	-	-	-	-	-	-	-	-	-	-	-	-
Eulalia bilineata	-	-	-	-	-	-	-	-	-	-	-	-	-
Eulalia viridis	-	-	-	-	-	-	-	-	-	-	-	-	-
Clymenella torquata	-	-	-	-	-	-	-	-	-	-	-	-	-
Maldane sarsi	-	-	-	-	-	-	-	-	-	-	-	-	-
Nereis succinea	-	-	-	-	Q	742	Q	Q	-	-	1008	14	14
Sabellaria vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-
Ampharete sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Glycera americana	-	-	-	-	-	-	-	-	-	-	-	-	-
Glycera dibranchiata	-	-	-	-	-	-	-	-	-	-	-	-	-
Glycera sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirratulus grandis	-	-	-	-	-	-	-	-	-	-	-	-	-
Dodecaceria coralii	-	-	-	-	-	-	-	-	-	-	-	-	-
Tharyx acutus	-	-	-	-	-	-	-	-	-	-	-	-	-
Pherusa affinis	-	-	-	-	-	-	-	-	-	-	-	-	-
Arenicola sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora commensalis	-	-	-	-	-	-	-	-	-	-	-	-	-
Polydora ligni	-	-	-	-	-	-	Q	Q	-	-	546	-	-
Lepidonotus squamatus	-	-	-	-	Q	-	-	-	-	-	-	-	-
Harmothoe extenuata	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammotrypane aulogaster	-	-	-	-	-	-	-	-	-	-	-	-	-
Stauronereis rudolphi	-	-	-	-	-	1022	Q	Q	-	-	20720	-	-
Unidentified	-	-	-	-	Q	-	-	-	-	-	140	-	-

Q = Qualitative Sample

TABLE 16
BENTHIC ORGANISMS
NEW HAVEN HARBOR AND TRIBUTARIES
SEPTEMBER 1967

(NUMBERS PER SQUARE METER)

STATION NUMBER	14	15	16	17	18	19	20	21	22	23	24	25	26
Marine Worms (Polychaeta)													
Paraonidae	-	-	14	-		-	-	-	-	-	-	-	-
Terebellidae	-	-	-	-		-	-	-	-	-	-	-	Q
Cystenides gouldii	-	-	-	-		Q	14	14	-	-	-	-	-
Lumbrineris sp.	-	-	-	-		-	-	-	-	-	-	-	Q
Sigalionidae	-	-	14	-		-	-	-	-	-	Q	-	Q
Nephtys incisa	-	-	-	-		-	112	-	42	-	-	-	-
Nephtys caeca	-	-	70	-		-	-	-	-	-	-	-	-
Nephtys picta	-	-	-	-		-	-	-	-	-	-	-	-
Arabella iricolor	-	-	-	-		-	-	-	-	-	-	-	-
Phyllodoce groenlandica	-	-	-	-		-	-	-	-	-	-	-	-
Eulalia bilineata	-	-	-	-		Q	-	210	-	28	Q	Q	-
Eulalia viridis	-	-	-	-		-	-	-	-	294	-	-	-
Clymenella torquata	-	-	-	-		-	-	-	-	-	-	-	-
Maldane sarsi	-	-	-	-		-	-	-	-	-	-	-	-
Nereis succinea	-	-	28	-		-	-	42	-	2114	Q	Q	Q
Sabellaria vulgaris	-	-	-	-		-	-	-	-	-	-	-	-
Ampharete sp.	-	-	-	-		-	-	-	-	-	-	-	-
Glycera americana	-	-	-	-		-	-	-	-	-	-	-	-
Glycera dibranchiata	-	-	-	-		-	-	-	-	198	-	-	-
Glycera sp.	-	-	-	-		-	-	-	-	-	-	-	-
Cirratulus grandis	-	-	-	-		-	-	-	-	-	-	-	-
Dodecaceria coralii	-	-	-	-		-	-	-	-	-	-	-	-
Tharyx acutus	-	-	-	-		-	-	-	-	-	-	-	-
Pherusa affinis	-	-	-	-		-	-	-	-	-	-	-	-
Arenicola sp.	-	-	28	-		-	-	-	-	-	Q	-	-
Polydora commensalis	-	-	-	-		-	-	-	-	-	-	-	-
Polydora ligni	-	-	-	-		-	-	-	-	588	-	-	-
Lepidonotus squamatus	-	-	-	-		-	-	14	-	-	-	-	-
Harmothoe extenuata	-	-	-	-		-	-	-	-	-	-	-	-
Ammotrypane aulogaster	-	-	-	-		-	-	-	-	-	-	-	-
Stauronereis rudolphi	-	-	1022	-		-	644	-	14	7980	Q	Q	-
Unidentified	-	-	-	-		-	14	42	-	-	Q	-	Q

Q = Qualitative Sample

BENTHIC ORGANISMS
NEW HAVEN HARBOR AND TRIBUTARIES
SEPTEMBER 1967

(NUMBERS PER SQUARE METER)

STATION NUMBER	27	28	29	30	31	32	33	34	35	36	37	38	39
Marine Worms (Polychaeta)													
Paraonidae	-	-	-	-	-	-	-	-	-	-	-	-	-
Terebellidae	-	-	-	-	-	-	-	-	-	-	-	-	70
Cystenides gouldii	-	14	-	-	-	-	-	-	-	-	-	-	-
Lumbrineris sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Sigalionidae	-	-	-	-	-	-	-	-	14	-	-	-	-
Nephtys incisa	-	56	42	-	70	28	-	-	-	28	-	-	14
Nephtys caeca	14	-	-	-	-	-	-	-	-	-	Q	-	-
Nephtys picta	-	-	-	-	-	-	-	-	42	-	-	-	-
Arabella iricolor	-	-	-	-	-	-	-	Q	-	-	Q	-	-
Phyllodoce groenlandica	-	-	-	-	-	-	-	-	-	-	-	-	14
Eulalia bilineata	-	-	-	-	-	-	154	-	-	-	Q	140	-
Eulalia viridis	-	-	-	-	-	-	-	-	-	-	-	-	-
Clymenella torquata	-	-	-	-	-	-	-	-	-	-	-	-	56
Maldane sarsi	-	-	-	-	-	-	-	-	-	-	-	-	14
Nereis succinea	-	-	-	-	-	-	42	-	-	-	-	-	42
Sabellaria vulgaris	-	-	-	-	-	-	-	Q	-	-	Q	14	-
Ampharete sp.	-	-	-	-	-	-	-	-	-	-	-	-	42
Glycera americana	-	-	-	-	-	-	-	-	-	-	-	-	14
Glycera dibranchiata	-	-	-	-	-	-	-	-	-	-	-	-	-
Glycera sp.	-	-	-	-	-	-	-	-	-	-	-	-	14
Cirratulus grandis	-	-	-	-	-	-	-	Q	-	-	-	-	56
Dodecaceria coralii	-	-	-	-	-	-	14	-	-	-	-	-	-
Tharyx acutus	-	-	-	-	-	-	14	-	-	-	-	-	-
Pherusa affinis	-	-	-	-	-	-	-	-	-	-	-	-	14
Arenicola sp.	-	-	-	812	-	-	-	-	-	-	Q	14	-
Polydora commensalis	-	-	-	-	-	-	-	-	-	-	-	-	28
Polydora ligni	-	-	-	-	-	-	-	-	-	-	-	-	14
Lepidonotus squamatus	-	-	-	-	-	-	-	-	-	-	Q	84	-
Harmothoe extenuata	-	-	-	Q	-	-	28	-	-	-	-	-	-
Ammotrypane aulogaster	-	-	-	-	-	-	-	-	-	-	-	-	42
Stauronereis rudolphi	28	-	-	266	-	-	14	Q	-	-	-	-	56
Unidentified	-	-	-	-	-	-	238	Q	-	-	Q	56	70

Q = Qualitative Sample

TABLE 16 (Continued)
(NUMBERS PER SQUARE METER)

STATION NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13
Bivalve Mollusks													
Tellina agilis	-	-	-	-	-	-	-	-	-	-	-	-	-
Yoldia limatula	-	-	-	-	-	-	-	-	-	-	-	-	-
Spisula solidissima	-	-	-	-	-	-	-	-	-	-	-	-	-
Pandora gouldiana	-	-	-	-	-	-	-	-	-	-	-	-	-
Nucula proxima	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercenaria mercenaria	-	-	-	-	-	-	-	-	-	-	-	-	-
Lyonsia hyalina	-	-	-	-	-	-	-	-	-	-	-	-	-
Gemma gemma	-	-	-	-	-	-	-	-	-	-	-	-	-
Petricola pholadiformis	-	-	-	-	-	-	-	-	-	-	-	-	-
Mya arenaria	-	-	-	-	-	-	-	Q	-	-	14	-	-
Modiolus demissus	-	-	-	-	-	-	-	Q	-	-	-	-	-
Unidentified	20	-	-	-	-	-	-	-	-	-	-	-	-
Snails (Gastropoda)													
Nassarius trivittatus	-	-	-	-	-	-	Q	-	-	-	-	42	-
Nassarius obsoletus	-	-	-	-	-	-	-	Q	-	-	462	-	-
Retusa obtusa	-	-	-	-	-	-	-	-	-	-	-	-	-
Polinices duplicata	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula plana	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula fornicata	-	-	-	-	-	-	-	-	-	-	-	-	-
Crabs (Decapoda)													
Neopanope texana	-	-	-	-	-	-	-	-	-	-	14	-	-
Rhithropanopeus harrisi	-	-	-	-	Q	-	Q	Q	-	-	-	-	-
Pagurus longicarpus	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-	-	-	14	-	-
Shrimp (Decapoda)													
Palaemonetes vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-
Sowbugs (Isopoda)													
Edotea triloba	-	-	-	-	-	-	Q	Q	-	-	-	-	-
Cyathura polita	-	-	-	-	-	56	-	-	-	-	-	-	-
Asellus sp.	90	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-	-	-	-	-	-
Scuds (Amphipoda)													
Caprellidea	-	-	-	-	-	-	-	-	-	-	-	-	-
Gammaridea	-	-	-	-	-	-	Q	Q	-	-	910	-	-
Unidentified	-	-	-	-	-	-	-	-	-	-	-	-	-

Q = Qualitative Sample

TABLE 16 (Continued)
(NUMBERS PER SQUARE METER)

STATION NUMBER	14	15	16	17	18	19	20	21	22	23	24	25	26
Bivalve Mollusks													
Tellina agilis	-	-	14	-	-	-	-	-	-	140	-	-	Q
Yoldia limatula	-	-	-	-	-	-	266	-	56	-	Q	-	-
Spisula solidissima	-	-	-	14	-	-	406	14	-	42	-	-	Q
Pandora gouldiana	-	-	-	-	-	-	-	-	-	-	-	-	Q
Nucula proxima	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercenaria mercenaria	-	-	14	-	-	-	-	14	-	-	-	-	-
Lyonsia hyalina	-	-	-	-	-	-	-	-	-	14	-	-	-
Gemma gemma	-	-	-	-	-	-	-	-	-	-	-	-	Q
Petricola pholadiformis	-	-	-	-	-	-	-	-	-	-	-	-	-
Mya arenaria	-	-	-	-	-	-	-	-	-	98	-	-	-
Modiolus demissus	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-	-	-	-	-	-
Snails (Gastropoda)													
Nassarius trivittatus	-	-	-	28	-	-	-	14	14	126	-	Q	Q
Nassarius obsoletus	-	28	238	28	126	Q	-	-	-	406	Q	-	-
Retusa obtusa	-	-	-	-	-	-	-	-	-	-	-	-	-
Polinices duplicata	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula plana	-	-	-	-	-	-	-	504	-	-	Q	Q	-
Crepidula fornicata	-	-	56	-	-	Q	-	266	-	-	Q	Q	Q
Crabs (Decapoda)													
Neopanope texana	-	-	98	-	-	Q	-	-	-	14	Q	-	Q
Rhithropanopeus harrisi	-	-	-	-	-	-	-	-	-	-	Q	-	-
Pagurus longicarpus	-	-	-	-	-	-	-	-	-	-	Q	Q	Q
Unidentified	-	-	-	-	-	-	-	28	-	70	Q	Q	-
Shrimp (Decapoda)													
Palaemonetes vulgaris	-	-	-	-	-	Q	-	-	-	-	-	-	-
Sowbugs (Isopoda)													
Edotea triloba	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyathura polita	-	-	-	-	-	-	-	-	-	-	-	-	-
Asellus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-	-	14	Q	Q	Q
Scuds (Amphipoda)													
Caprellidea	-	-	-	-	-	-	-	-	-	-	-	-	-
Gammaridea	-	-	798	-	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-	-	1008	-	-	Q

Q = Qualitative Sample

TABLE 16 (Continued)
(NUMBERS PER SQUARE METER)

STATION NUMBER	27	28	29	30	31	32	33	34	35	36	37	38	39
Bivalve Mollusks													
Tellina agilis	-	-	-	840	-	-	14	Q	28	28	Q	-	406
Yoldia limatula	280	1344	798	-	1008	238	-	-	-	392	-	-	210
Spisula solidissima	28	-	14	14	1002	28	-	Q	-	-	-	-	672
Pandora gouldiana	-	-	-	14	-	-	-	-	-	14	Q	-	
Nucula proxima	-	-	42	-	280	-	-	-	-	168	-	-	4480
Mercenaria mercenaria	-	-	-	14	28	-	-	-	-	-	-	-	-
Lyonsia hyalina	-	-	-	-	-	-	-	-	-	-	-	-	14
Gemma gemma	-	-	-	28	-	-	-	-	-	-	-	-	-
Petricola pholadiformis	-	-	-	-	-	-	-	-	-	-	-	-	14
Mya arenaria	-	-	-	-	-	-	-	-	-	-	-	-	-
Modiolus demissus	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-	-	-	-	-	-
Snails (Gastropoda)													
Nassarius trivittatus	98	28	84	406	70	84	84	Q	98	126	-	14	14
Nassarius obsoletus	14	-	-	-	-	-	-	-	-	-	-	-	-
Retusa obtusa	224	28	-	70	-	-	-	-	-	42	-	-	-
Polinices duplicata	-	-	-	Q	-	-	-	Q	-	-	-	-	-
Crepidula plana	-	-	-	Q	-	-	42	Q	-	-	Q	532	-
Crepidula fornicata	-	-	-	Q	-	-	-	-	-	-	-	14	-
Crabs (Decapoda)													
Neopanope texana	-	-	-	Q	-	-	28	Q	-	-	Q	28	-
Rhithropanopeus harrisi	-	-	-	-	-	-	-	-	-	-	-	-	-
Pagurus longicarpus	-	-	-	70	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	168	-	-	-	Q	42	-
Shrimp (Decapoda)													
Palaemonetes vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-
Sowbugs (Isopoda)													
Edotea triloba	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyathura polita	-	-	-	-	-	-	-	-	-	-	-	-	-
Asellus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	42	-	-	1008	Q	14	-	Q	770	28
Scuds (Amphipoda)													
Caprellidea	-	-	-	-	-	-	182	-	-	-	Q	560	-
Gammaridea	-	-	-	-	-	-	-	-	-	-	-	14	-
Unidentified	14	-	-	-	-	-	-	Q	14	-	-	-	-

Q = Qualitative Sample

TABLE 16 (Continued)

(NUMBERS PER SQUARE METER)

STATION NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13
Mysids (Mysidacea)													
Meterythrop robusta	-	-	-	-	-	-	-	-	-	-	-	-	-
Heteromysis formosa	-	-	-	-	-	-	-	-	-	-	-	-	-
Neomysis americana	-	-	-	-	-	-	-	-	-	-	-	-	-
Barnacle (Cirripedia)													
Balanus sp.	-	-	-	-	Q	-	-	Q	-	-	434	-	-
Seed Shrimp (Ostracoda)	10	-	-	-	-	-	-	-	-	-	-	-	-
Copepod (Copepoda)	-	-	-	-	-	-	-	-	-	-	-	-	-
Cumaceans (Cumacea)	-	-	-	-	-	14	-	Q	-	-	-	-	-
Water Flea (Cladocera)	70	-	-	-	-	-	-	-	-	-	-	-	-
Hydroids (Hydrozoa)													
Podocoryne carnea	-	-	-	-	-	-	-	-	-	-	-	-	-
Bougainvillia carolinensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydra sp.	20	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-	-	-	-	-	-
Insects (Insecta)													
Atherix variegata	300	-	-	-	-	-	-	-	-	-	-	-	-
Hydropsyche sp.	300	-	-	-	-	-	-	-	-	-	-	-	-
Berosus sp.	10	-	-	-	-	-	-	-	-	-	-	-	-
Chironomidae (not gilled)	10	-	-	-	-	-	-	-	-	-	-	-	-
Worm (Oligochaeta)													
Tubificid (not gilled)	70	-	-	-	-	-	-	-	-	-	-	-	56
Starfish (Echinodermata)													
Asterias vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-
Asterias forbesi	-	-	-	-	-	-	-	-	-	-	-	-	-
Moss Animal (Ectoprocta)	-	-	-	-	-	-	-	-	-	-	-	-	-
Roundworm (Nematoda)	-	-	-	-	-	42	Q	Q	-	-	728	-	-
TOTAL ORGANISMS	1200					1876					25130	56	70
TOTAL KINDS	10				5	5	8	13			12	2	2

Q = Qualitative Sample

TABLE 16 (Continued)

(NUMBERS PER SQUARE METER)

STATION NUMBER	14	15	16	17	18	19	20	21	22	23	24	25	26
Mysids (Mysidacea)													
Meterythrop robusta	-	-	-	-	-	-	-	14	-	-	-	-	-
Heteromysis formosa	-	-	42	-	-	-	-	-	-	-	Q	Q	Q
Neomysis americana	-	-	14	-	-	-	-	-	-	-	-	-	-
Barnacle (Cirripedia)													
Balanus sp.	-	-	-	-	-	-	-	-	-	14	-	-	-
Seed Shrimp (Ostracoda)	-	-	-	-	-	-	-	-	-	-	-	-	-
Copepod (Copepoda)	-	-	-	-	-	-	-	-	-	-	-	-	-
Cumaceans (Cumacea)	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Flea (Cladocera)	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydroids (Hydrozoa)													
Podocoryne carnea	-	-	-	-	-	-	-	-	-	Q	-	-	-
Bougainvillia carolinensis	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydra sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	-	-	-	-	-	-	-
Insects (Insecta)													
Atherix variegata	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydropsyche sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Berosus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Chironomidae (not gilled)	-	-	-	-	-	-	-	-	-	-	-	-	-
Worm (Oligochaeta)													
Tubificid (not gilled)	-	-	-	-	-	-	-	-	-	-	-	-	-
Starfish (Echinodermata)													
Asterias vulgaris	-	-	-	-	-	-	-	-	-	-	-	-	-
Asterias forbesi	-	-	-	-	-	-	-	-	-	-	-	-	-
Moss Animal (Ectoprocta)	-	-	-	-	-	-	-	-	-	-	-	-	-
Roundworm (Nematoda)	-	-	840	-	-	-	308	-	-	1526	Q	Q	Q
TOTAL ORGANISMS		28	3290	70	126		1769	1176	126	14674			
TOTAL KINDS		1	15	3	1	6	7	12	4	19	17	11	17

Q = Qualitative Sample

TABLE 16 (Continued)

(NUMBERS PER SQUARE METER)

STATION NUMBER	27	28	29	30	31	32	33	34	35	36	37	38	39
Mysids (Mysidacea)													
Meterythrop robusta	-	-	-	-	-	-	-	Q	-	-	Q	-	-
Heteromysis formosa	-	-	-	-	-	-	-	Q	-	-	Q	70	-
Neomysis americana	-	-	-	-	-	-	-	-	-	-	-	-	-
Barnacle (Cirripedia)													
Balanus sp.	-	-	-	-	-	-	-	Q	-	-	-	-	-
Seed Shrimp (Ostracoda)	-	-	-	-	-	-	-	-	-	-	-	-	-
Copepod (Copepoda)	-	-	-	-	-	-	-	-	-	-	-	28	-
Cumaceans (Cumacea)	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Flea (Cladocera)	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydroids (Hydrozoa)													
Podocoryne carnea	-	-	-	Q	-	-	Q	Q	-	-	-	Q	Q
Bougainvillia carolinensis	-	-	-	-	-	-	-	-	-	-	-	14	-
Hydra sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified	-	-	-	-	-	-	28	-	-	-	-	-	-
Insects (Insecta)													
Atherix variegata	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydropsyche sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Berosus sp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Chironomidae (not gilled)	-	-	-	-	-	-	-	-	-	-	-	-	-
Worm (Oligochaeta)													
Tubificid (not gilled)	-	-	-	-	-	-	-	-	-	-	-	-	-
Starfish (Echinodermata)													
Asterias vulgaris	-	-	-	-	-	-	-	-	-	-	-	14	-
Asterias forbesi	-	-	-	-	-	14	-	-	-	-	-	-	-
Moss Animal (Ectoprocta)	-	-	-	-	-	-	Q	Q	-	-	-	-	-
Roundworm (Nematoda)	56	-	-	1918	-	-	322	Q	-	42	Q	42	-
TOTAL ORGANISMS	756	1470	980	4494	2478	392	2380		210	840		2450	6398
TOTAL KINDS	9	5	5	18	6	5	18	18	6	8	17	19	25

Q = Qualitative Sample

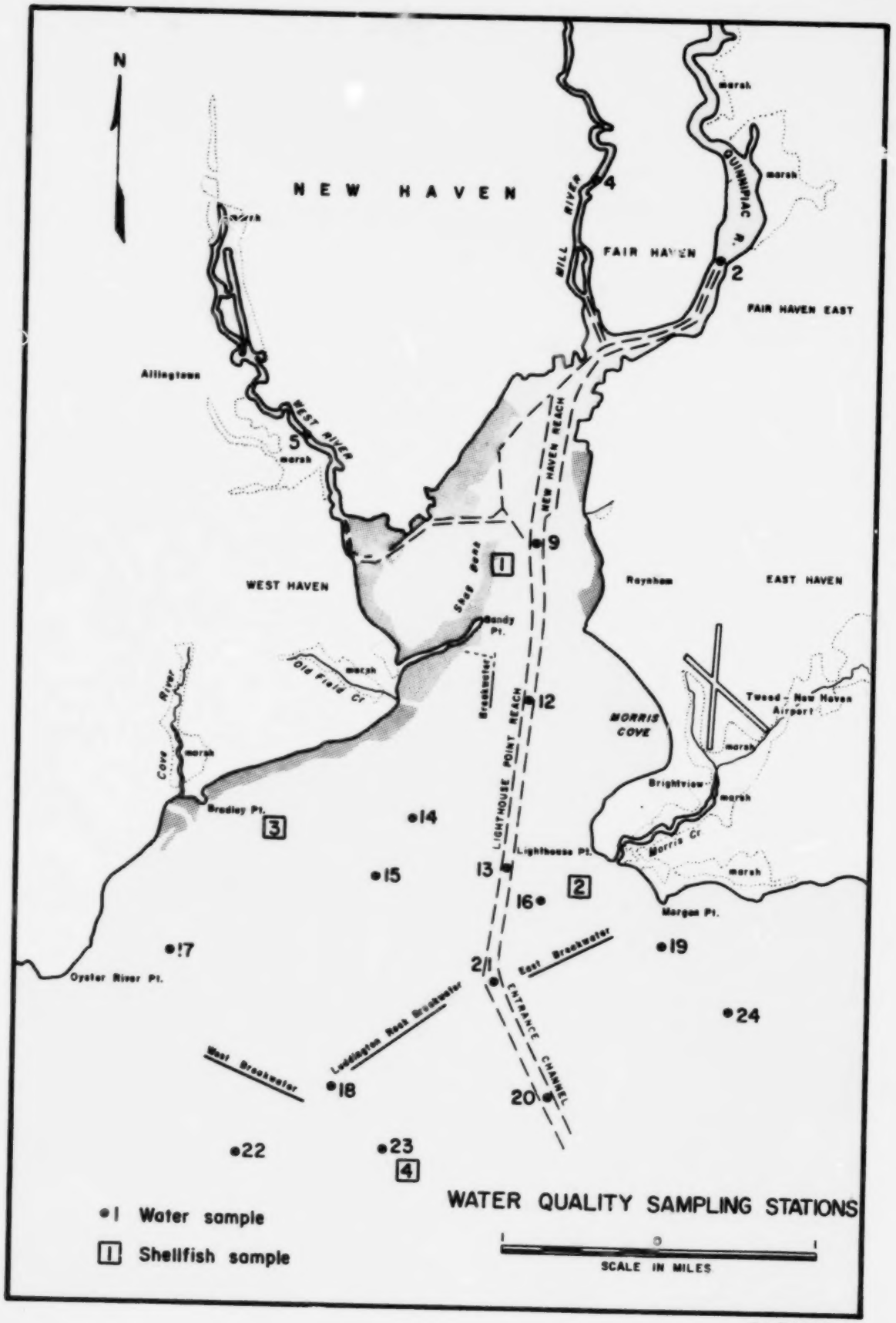
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
WEST HAVEN
EAST HAVEN
Allingtown
Rowhom
Bradley Pt.
Lighthouse Pt.
Morris Cr
Morgan Pt.
Oyster River Pt.
Sandy Pt.
Old Field Cr
Cove River
Brightview
Tweed - New Haven Airport
MORRIS COVE
LIGHTHOUSE POINT REACH
NEW HAVEN REACH
EAST BREAKWATER
WEST BREAKWATER
Luddington Rock Breakwater
ENTRANCE CHANNEL
marsh
WEST RIVER
MILL RIVER
QUINNIPIAC R.
SHAG POINT
1
2
3
4
5
9
11
12
13
14
15
16
17
18
19
20
22
23
24
•1 Water sample
[1] Shellfish sample
WATER QUALITY SAMPLING STATIONS
0
1
SCALE IN MILES

FIGURE 4

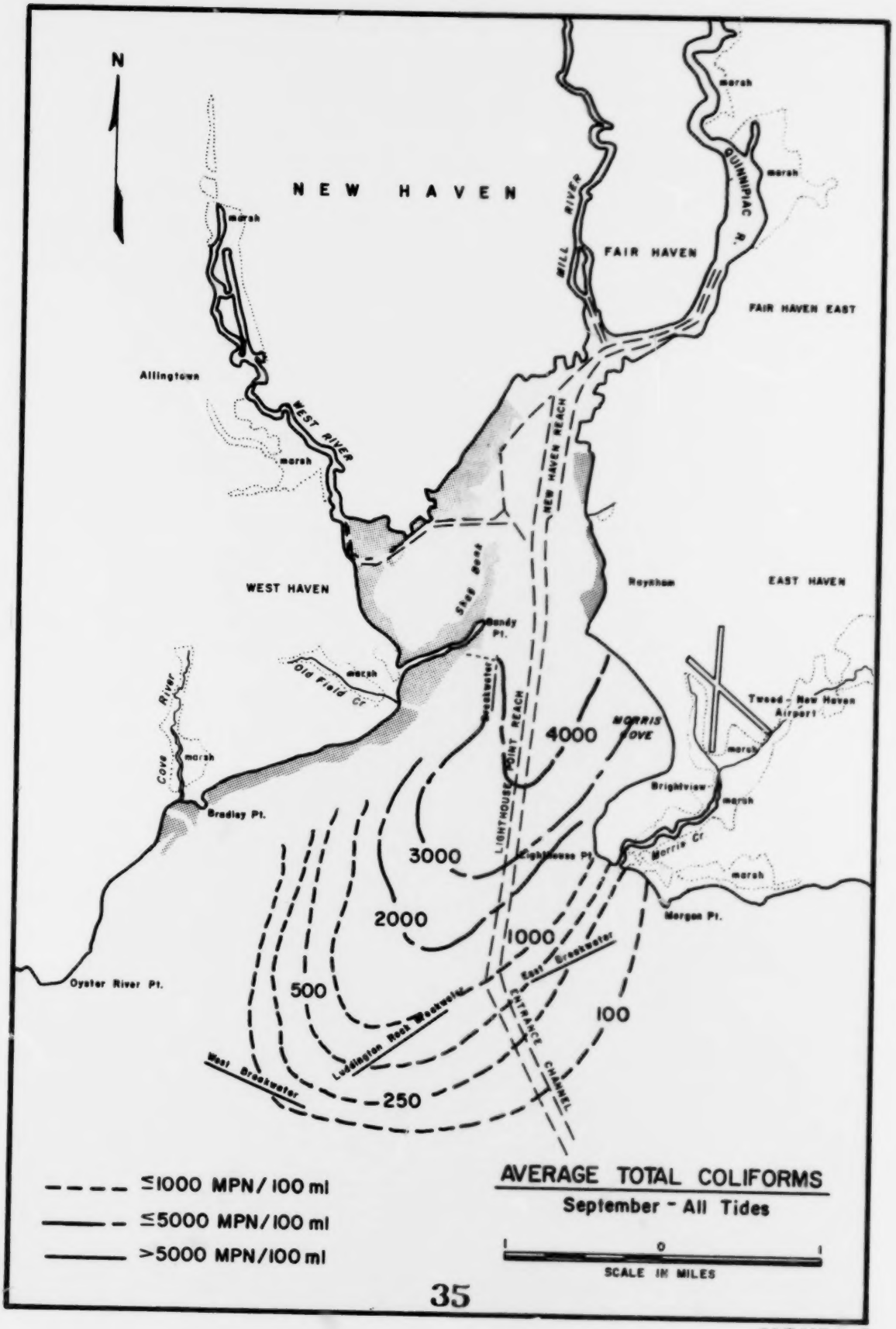
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
WEST HAVEN
EAST HAVEN
Allingtown
Roynhom
marsh
QUINNIPIAC R.
MILL RIVER
WEST RIVER
NEW HAVEN REACH
LIGHTHOUSE POINT REACH
Sandy Pt.
Old Field Cr
Cove River
Bradley Pt.
Oyster River Pt.
Tweed - New Haven Airport
Brightview
Morris Cr
Lighthouse Pt.
Morgan Pt.
East Breakwater
Luddington Rock Breakwater
West Breakwater
ENTRANCE CHANNEL
4000
3000
2000
1000
500
250
100
≤1000 MPN/100 ml
≤5000 MPN/100 ml
>5000 MPN/100 ml
AVERAGE TOTAL COLIFORMS
September - All Tides
1 0 1
SCALE IN MILES

FIGURE 5

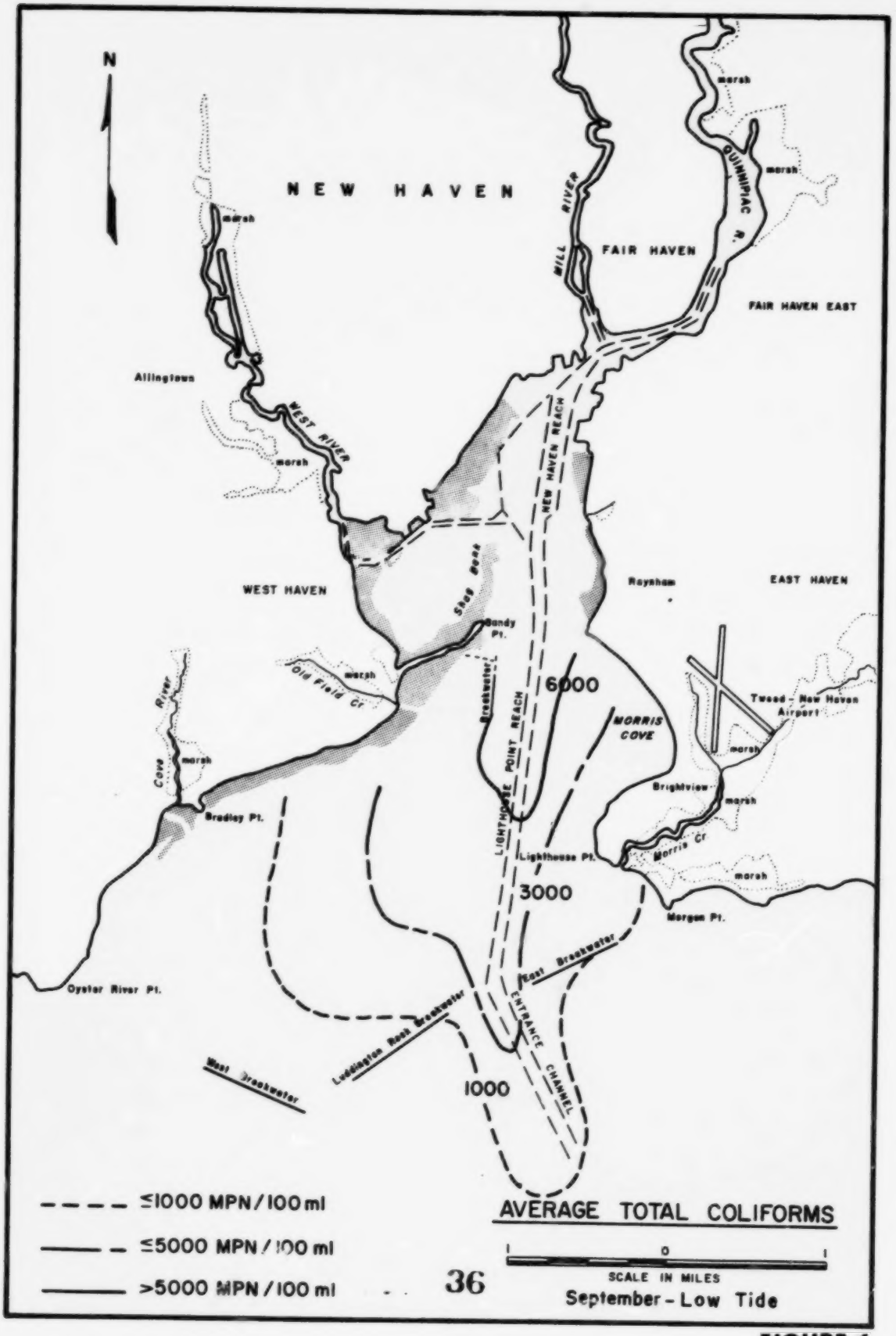
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
EAST HAVEN
WEST HAVEN
Allingtown
Raynham
Twead - New Haven Airport
Brightview
Bradley Pt.
Oyster River Pt.
Lighthouse Pt.
Morgan Pt.
Sandy Pt.
Mill River
Quinnipiac R.
West River
New Haven Reach
Lighthouse Point Reach
Morris Cove
Morris Cr
Old Field Cr
Cove River
Stub Area
Breakwater
East Breakwater
Entrance Channel
Leddington Rock Breakwater
West Breakwater
marsh
6000
3000
1000
≤1000 MPN/100 ml
≤5000 MPN/100 ml
>5000 MPN/100 ml
AVERAGE TOTAL COLIFORMS
0
SCALE IN MILES
September - Low Tide

FIGURE 6

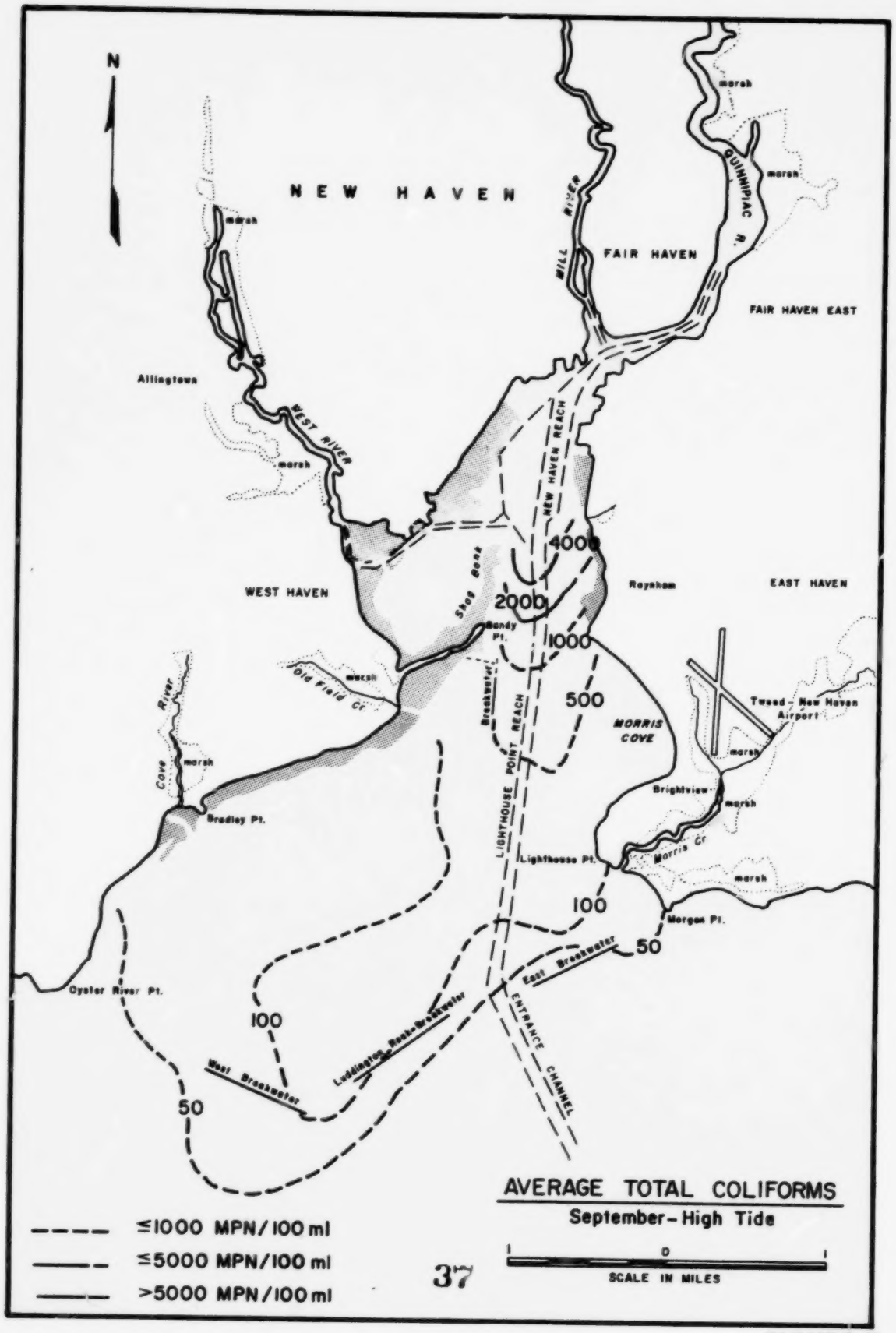
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
Allingtown
WEST HAVEN
Raynham
EAST HAVEN
MORRIS COVE
LIGHTHOUSE POINT REACH
NEW HAVEN REACH
MILL RIVER
QUINNIPIAC R.
WEST RIVER
Cove River
Old Field Cr.
Sandy Pt.
Breakwater
Tweed - New Haven Airport
Brightview
Morris Cr.
Lighthouse Pt.
Morgan Pt.
East Breakwater
ENTRANCE CHANNEL
Oyster River Pt.
Bradley Pt.
Luddington Rock-Breakwater
West Breakwater
marsh
4000
2000
1000
500
100
50
AVERAGE TOTAL COLIFORMS
September - High Tide
≤1000 MPN/100 ml
≤5000 MPN/100 ml
>5000 MPN/100 ml
0
1
SCALE IN MILES

FIGURE 7

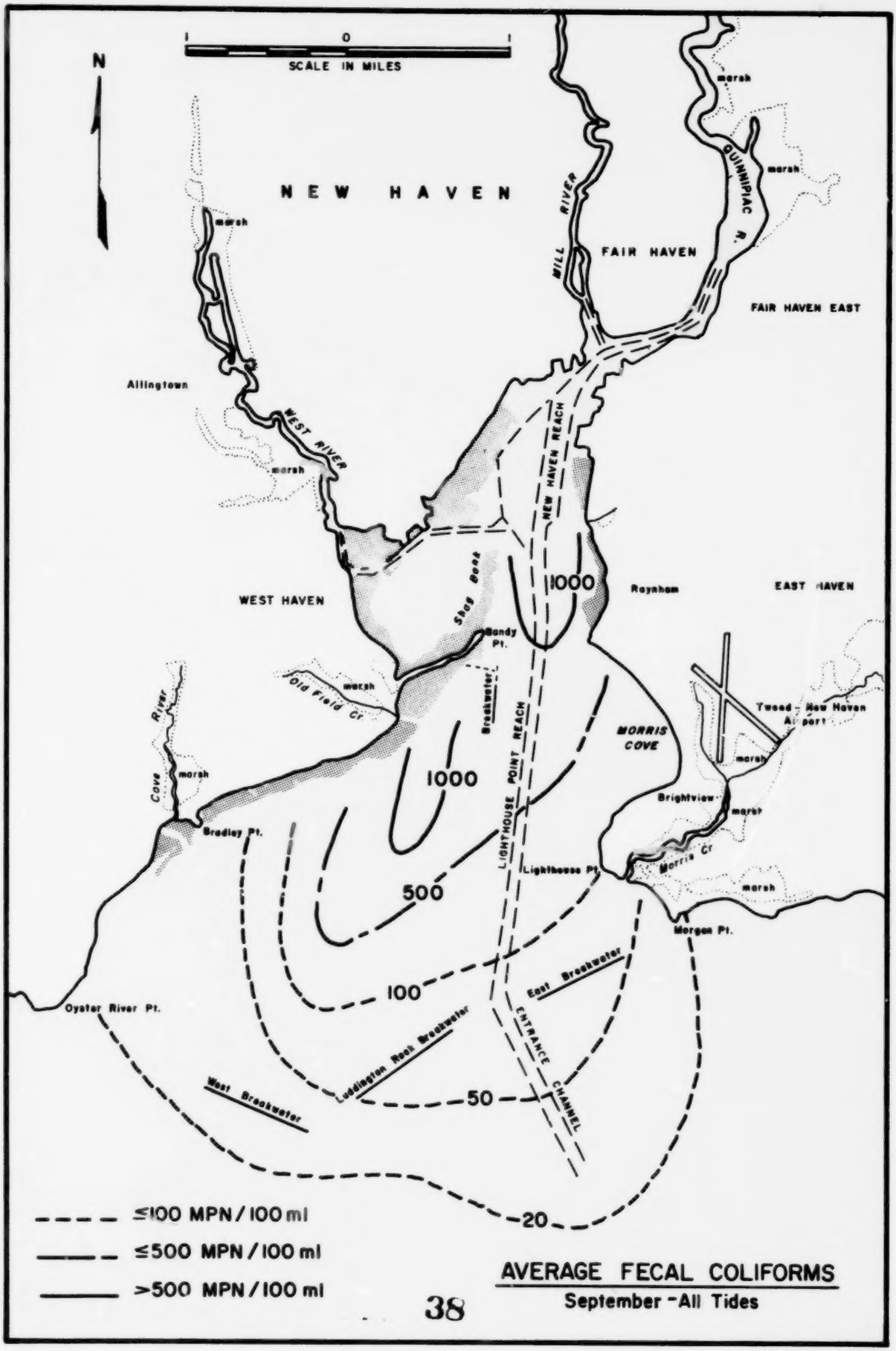
N
1 0 1
SCALE IN MILES
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
WEST HAVEN
EAST HAVEN
Allingtown
Reynham
MORRIS COVE
WEST RIVER
MILL RIVER
QUINNIPIAC R.
NEW HAVEN REACH
LIGHTHOUSE POINT REACH
ENTRANCE CHANNEL
Sandy Pt.
Old Field Cr.
Cove River
Bradley Pt.
Lighthouse Pt.
Morris Cr.
Morgan Pt.
Brightview
Tweed - New Haven Airport
Oyster River Pt.
East Breakwater
Leddington Rock Breakwater
West Breakwater
Shoal Area
Breakwater
marsh
1000
500
100
50
20
≤100 MPN/100 ml
≤500 MPN/100 ml
>500 MPN/100 ml
AVERAGE FECAL COLIFORMS
September - All Tides

FIGURE 8

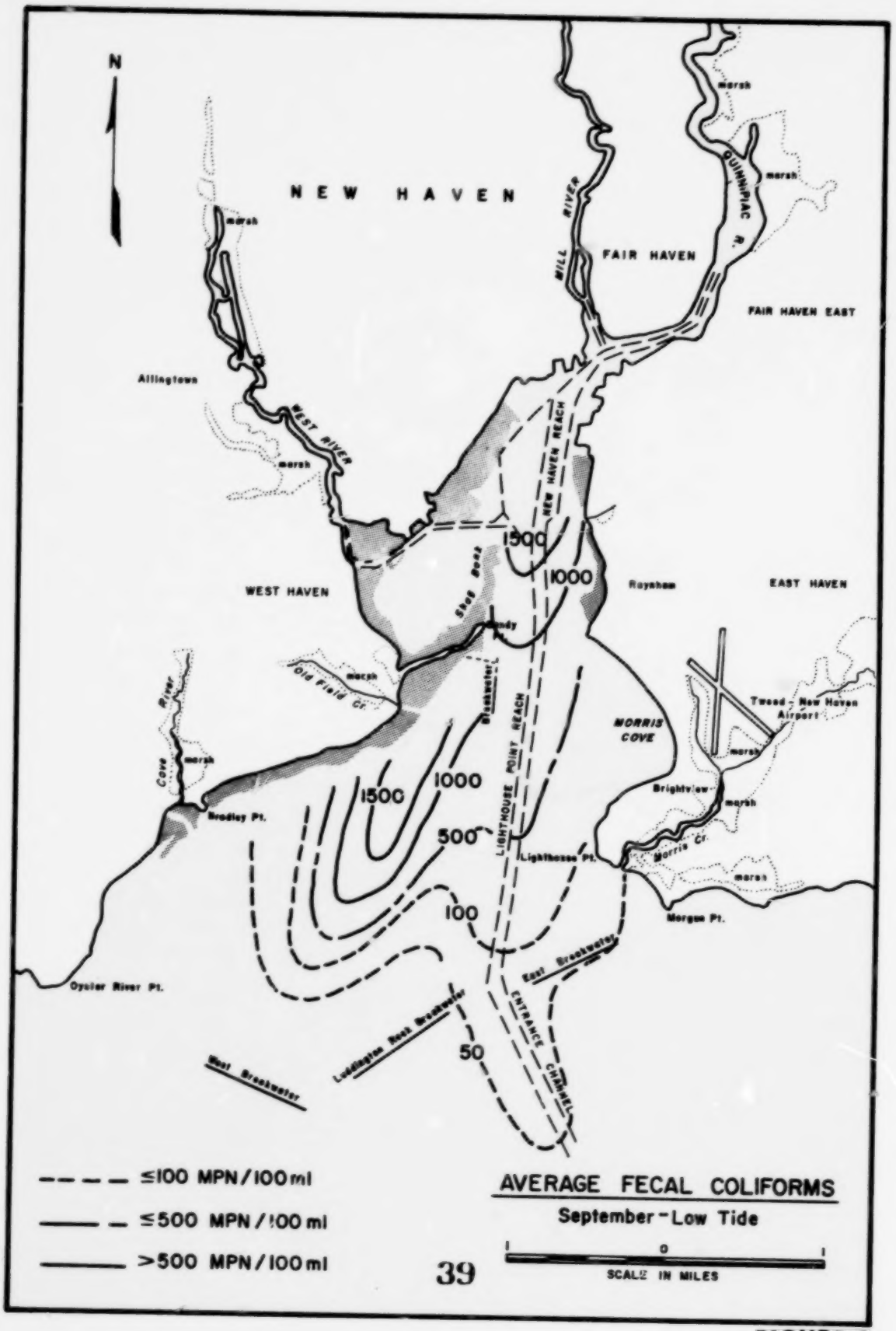
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
WEST HAVEN
EAST HAVEN
Allingtown
Roynhom
MORRIS COVE
Tweed - New Haven Airport
Brightview
Lighthouse Pt.
Morgan Pt.
Bradley Pt.
Oyster River Pt.
Cove River
Old Field Cr.
Morris Cr.
Mill River
Quinnipiac R.
West River
New Haven Reach
Lighthouse Point Reach
Entrance Channel
East Breakwater
Luddington West Breakwater
West Breakwater
Stony Creek
Breakwater
marsh
1500
1000
500
100
50
≤100 MPN/100 ml
≤500 MPN/100 ml
>500 MPN/100 ml
AVERAGE FECAL COLIFORMS
September - Low Tide
0
1
SCALE IN MILES

FIGURE 9

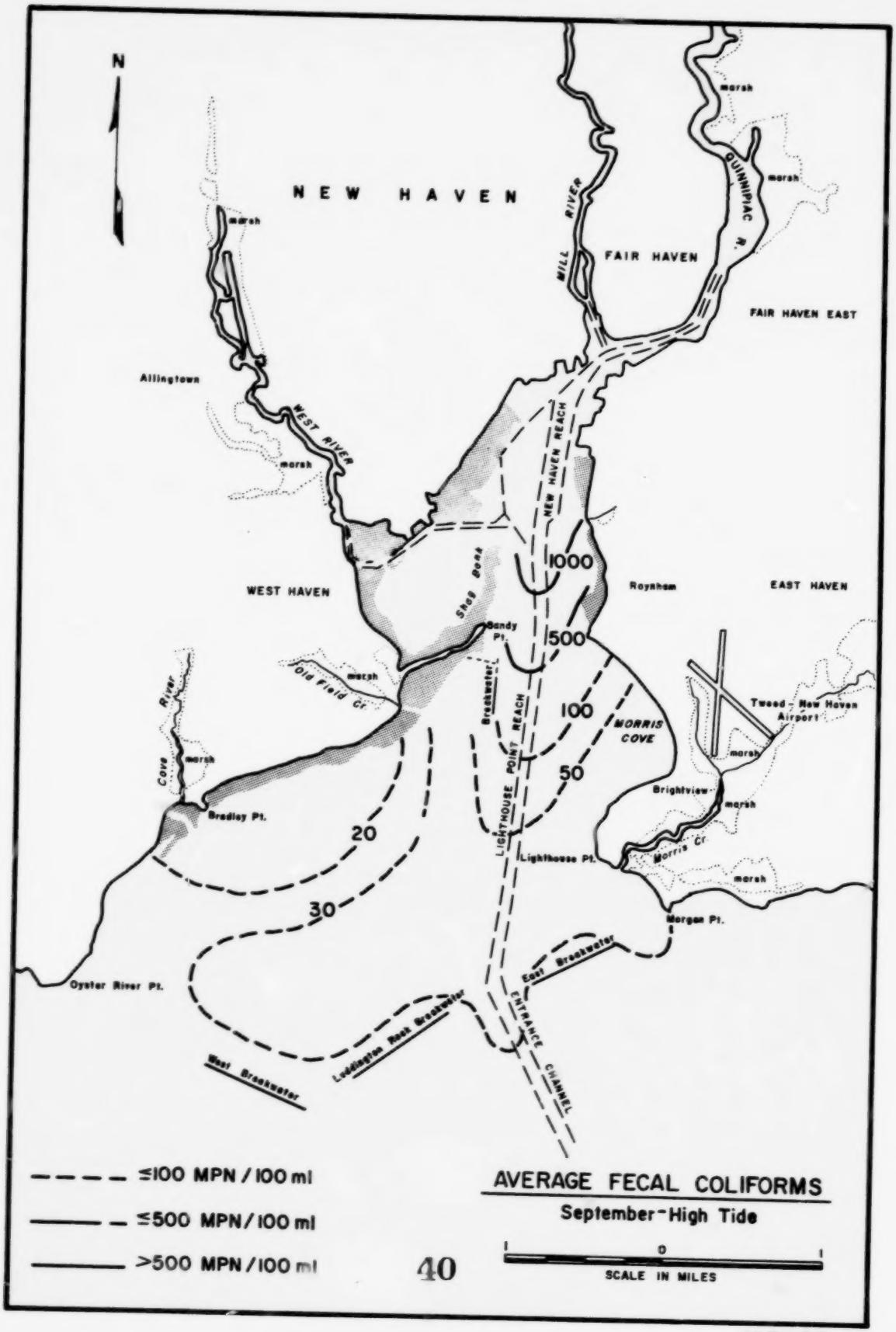
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
MILL RIVER
QUINNIPIAC R.
marsh
Allingtown
WEST RIVER
NEW HAVEN REACH
WEST HAVEN
Roynhom
EAST HAVEN
Shag Rock
Sandy Pt.
1000
500
100
50
20
30
Breakwater
LIGHTHOUSE POINT REACH
MORRIS COVE
Tweed - New Haven Airport
Brightview
Morris Cr.
Lighthouse Pt.
Morgan Pt.
Bradley Pt.
Cove River
Old Field Cr.
Oyster River Pt.
East Breakwater
ENTRANCE CHANNEL
Leddington Rock Breakwater
West Breakwater
≤100 MPN / 100 ml
≤500 MPN / 100 ml
>500 MPN / 100 ml
AVERAGE FECAL COLIFORMS
September - High Tide
1 0 1
SCALE IN MILES

FIGURE 10

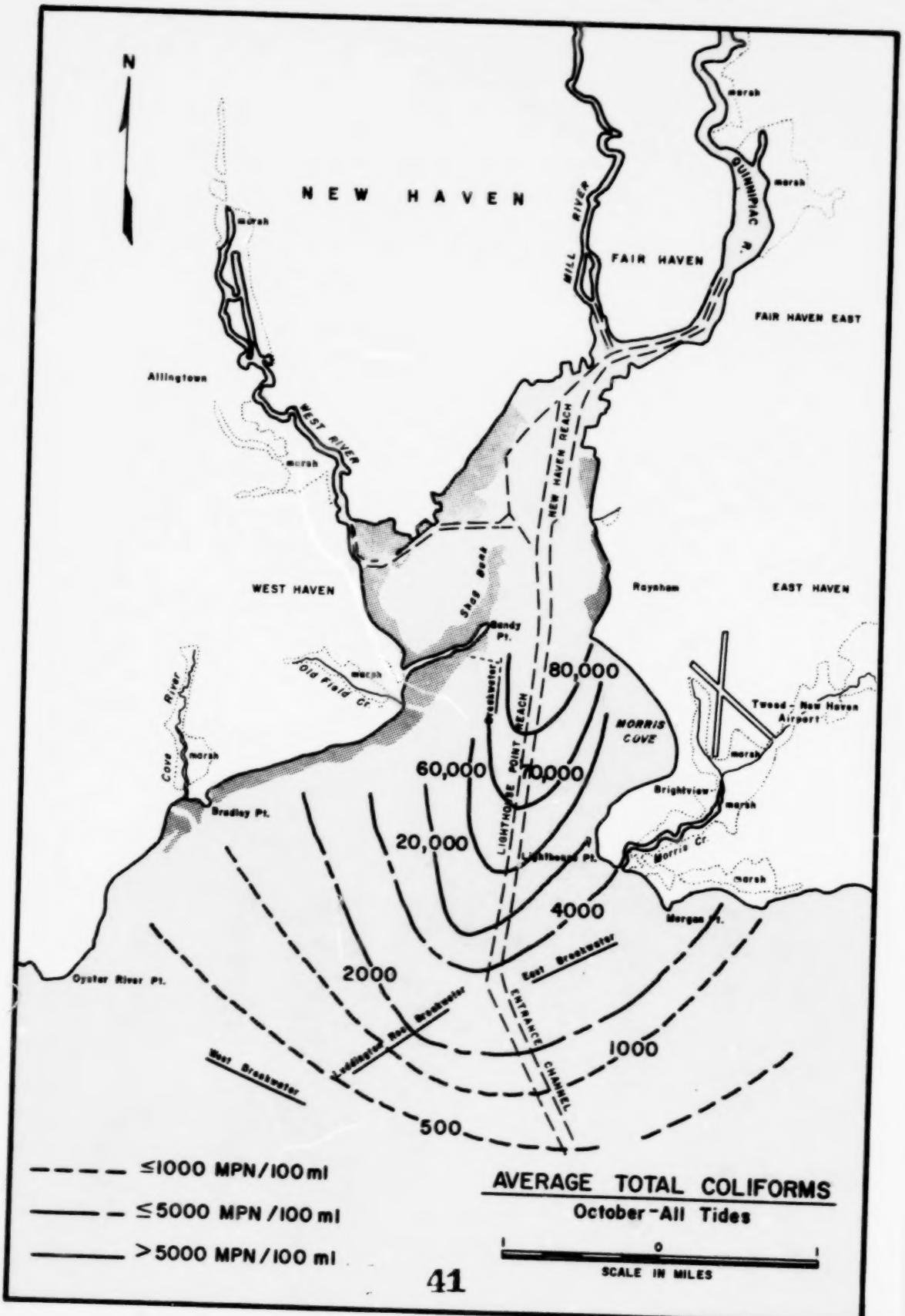
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
WEST HAVEN
EAST HAVEN
Allingtown
Raynham
marsh
MILL RIVER
QUINNIPIAC R.
WEST RIVER
NEW HAVEN REACH
LIGHTHOUSE POINT REACH
Shot Beak
Sandy Pt.
Gold Field Cr
Cove River
Bradley Pt.
MORRIS COVE
Tweed - New Haven Airport
Brightview
Morris Cr
Lighthouse Pt.
Morgan Pt.
Oyster River Pt.
East Breakwater
Breakwater
Saddleback Rock Breakwater
West Breakwater
ENTRANCE CHANNEL
80,000
60,000
40,000
20,000
4000
2000
1000
500
≤1000 MPN/100 ml
≤5000 MPN/100 ml
>5000 MPN/100 ml
AVERAGE TOTAL COLIFORMS
October - All Tides
0
SCALE IN MILES

FIGURE 11

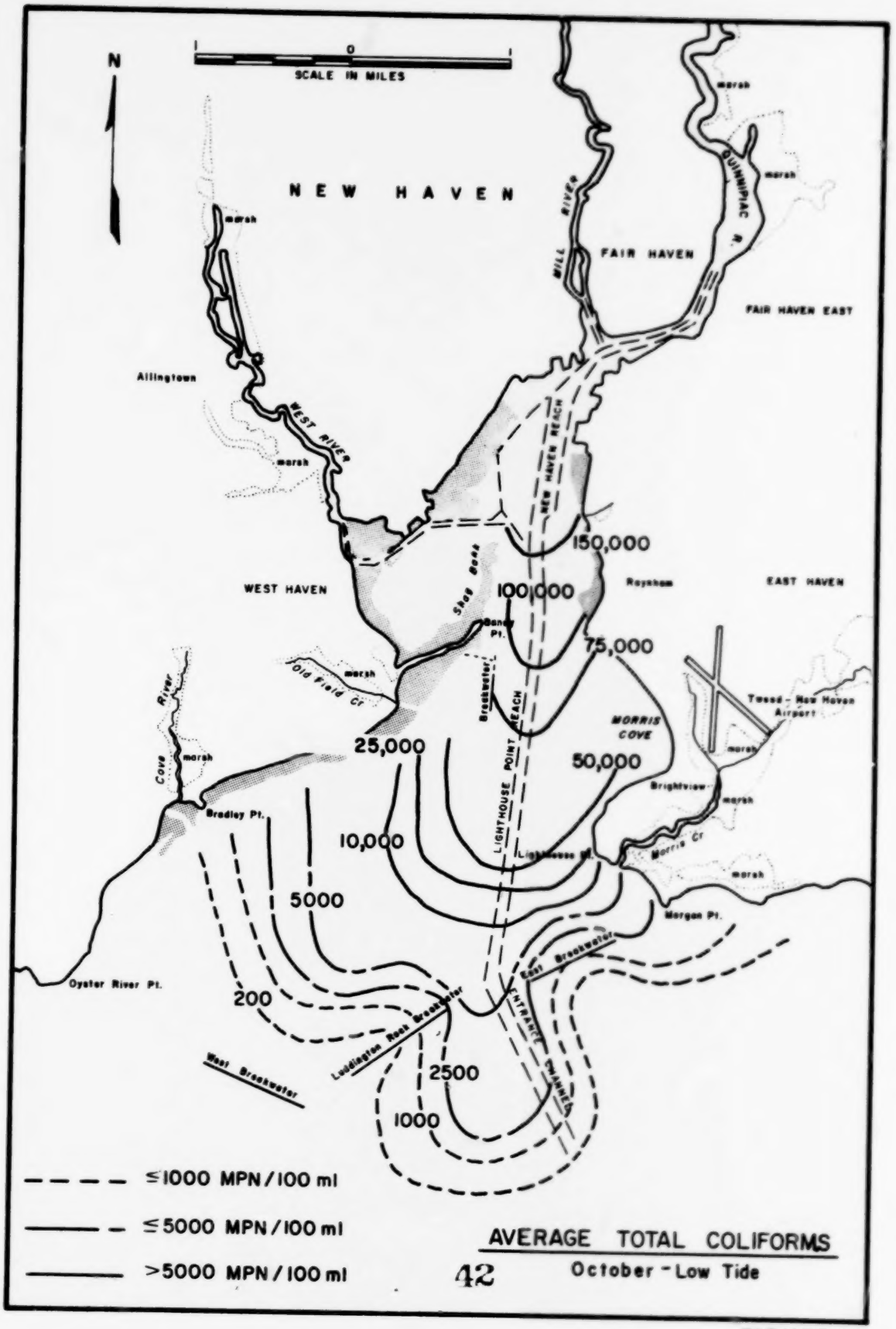
N
0
1
SCALE IN MILES
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
EAST HAVEN
WEST HAVEN
Allingtown
Raynham
Tweed - New Haven Airport
Brightview
Bradley Pt.
Oyster River Pt.
Morgan Pt.
Lighthouse Pt.
Sandy Pt.
Cove River
Old Field Cr
Morris Cr
Mill River
Quinnipiac R.
West River
New Haven Reach
Lighthouse Point Reach
Breakwater
Shoal Rock
MORRIS COVE
East Breakwater
Entrance Channel
Luddington Rock Breakwater
West Breakwater
marsh
150,000
100,000
75,000
50,000
25,000
10,000
5000
2500
1000
200
≤1000 MPN/100 ml
≤5000 MPN/100 ml
>5000 MPN/100 ml
AVERAGE TOTAL COLIFORMS
October - Low Tide

FIGURE 12

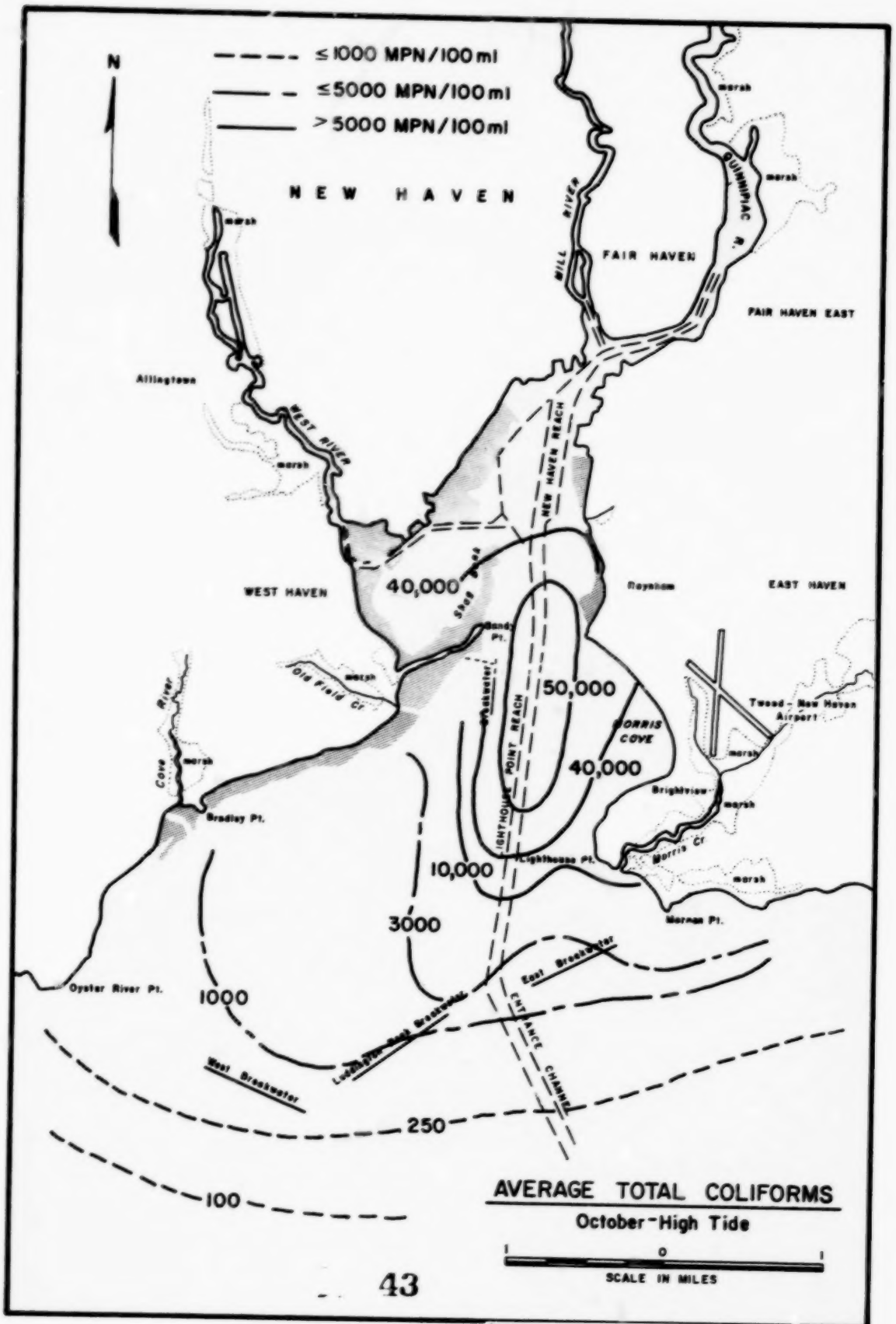

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FIGURE 13

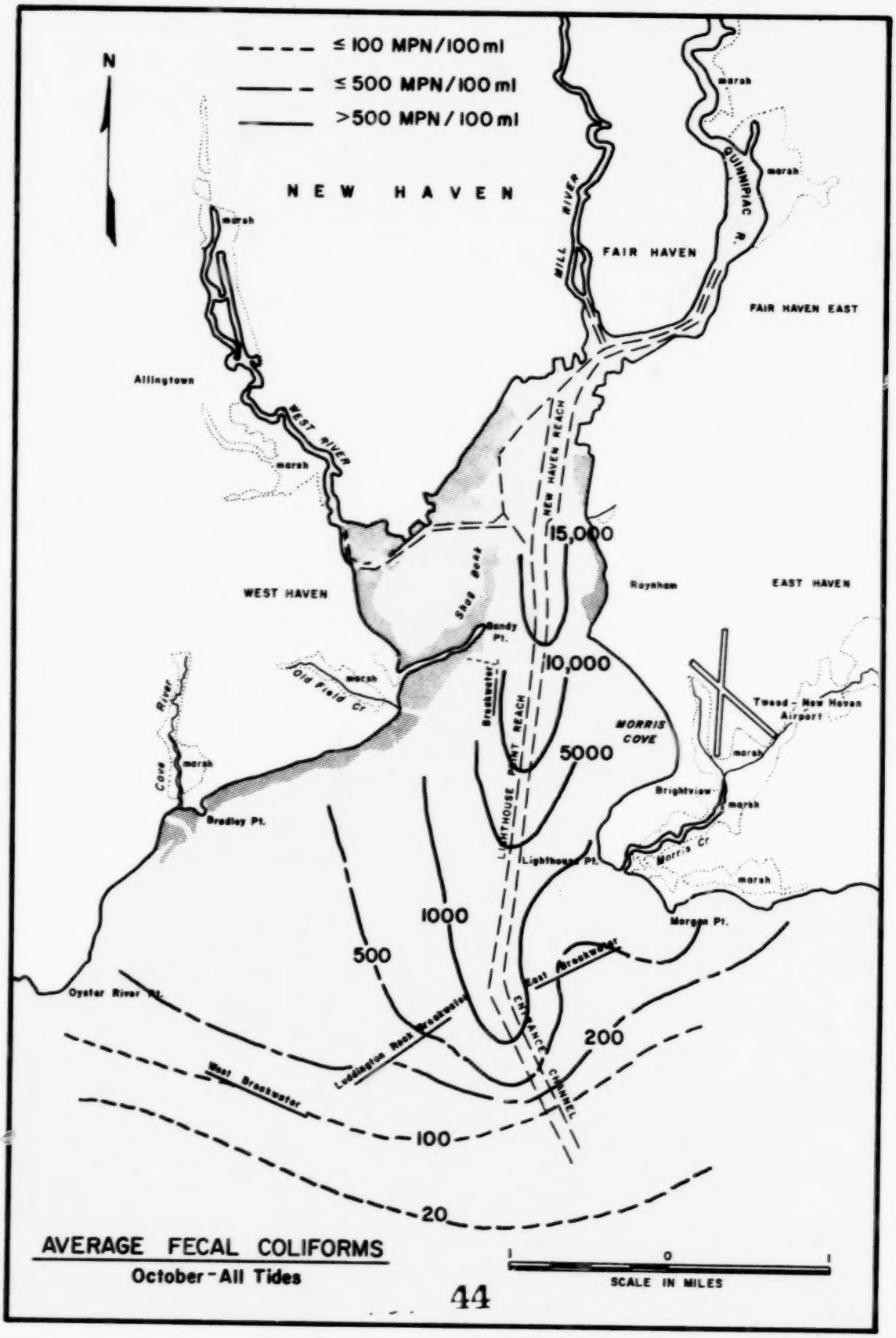
≤ 100 MPN/100 ml
≤ 500 MPN/100 ml
>500 MPN/100 ml
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
MILL RIVER
QUINNIPIAC R.
marsh
Allingtown
WEST RIVER
NEW HAVEN REACH
15,000
WEST HAVEN
Stag Rocks
Roynham
EAST HAVEN
Sandy Pt.
10,000
Old Field Cr
Breakwater
Tweed - New Haven Airport
MORRIS COVE
5000
Cove River
Brightview
Bradley Pt.
LIGHTHOUSE POINT REACH
Lighthouse Pt.
Morris Cr
1000
500
Morgan Pt.
East Breakwater
Oyster River Pt.
Long Island Sound
Leddington Rock Breakwater
ENTRANCE CHANNEL
200
West Breakwater
100
20
AVERAGE FECAL COLIFORMS
October - All Tides
1 0 1
SCALE IN MILES

FIGURE 14

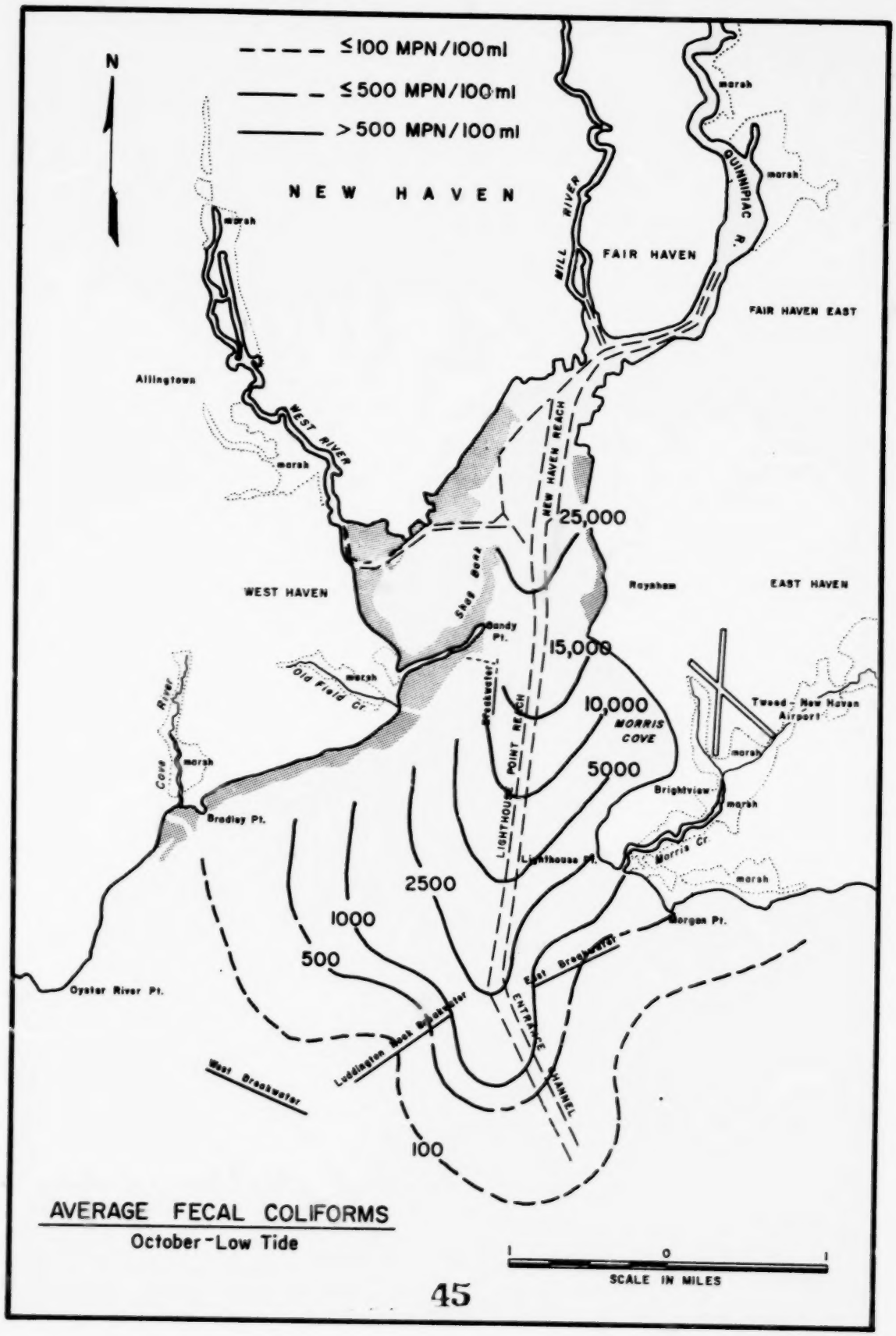
≤100 MPN/100ml
≤500 MPN/100ml
>500 MPN/100ml
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
WEST HAVEN
EAST HAVEN
Allingtown
Roynham
marsh
WEST RIVER
MILL RIVER
QUINNIPIAC R.
NEW HAVEN REACH
POINT REACH
LIGHTHOUSE
ENTRANCE CHANNEL
Shag Rock
Sandy Pt.
Cold Field Cr
Cove River
Bradley Pt.
Oyster River Pt.
Lighthouse Pt.
Morris Cr
Morgan Pt.
Brightview
Tweed - New Haven Airport
East Breakwater
Luddington Rock Breakwater
West Breakwater
25,000
15,000
10,000
MORRIS COVE
5000
2500
1000
500
100
AVERAGE FECAL COLIFORMS
October - Low Tide
1 0 1
SCALE IN MILES

FIGURE 15

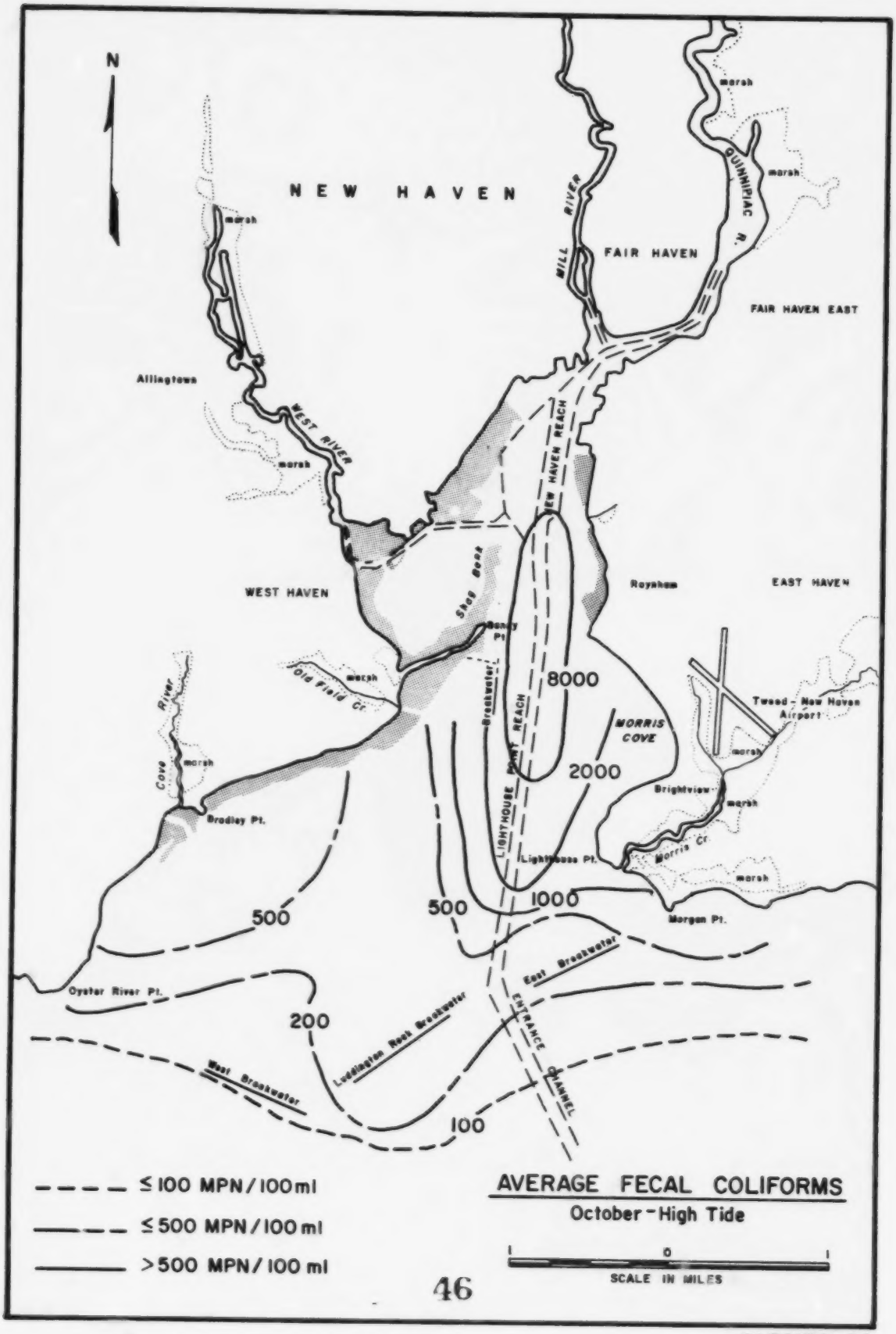
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
WEST HAVEN
EAST HAVEN
Allingtown
Royaltown
Tweed - New Haven Airport
MORRIS COVE
Brightview
Lighthouse Pt.
Morris Cr.
Morgan Pt.
Bradley Pt.
Oyster River Pt.
Cove River
Gold Field Cr.
Sandy Pt.
Stag Rocks
Breakwater
WEST RIVER
MILL RIVER
QUINNIPIAC R.
NEW HAVEN HARBOR REACH
LIGHTHOUSE POINT REACH
ENTRANCE CHANNEL
East Breakwater
Leddington Rock Breakwater
West Breakwater
marsh
8000
2000
1000
500
500
200
100
≤ 100 MPN/100ml
≤ 500 MPN/100 ml
>500 MPN/100 ml
AVERAGE FECAL COLIFORMS
October - High Tide
0
SCALE IN MILES

FIGURE 16

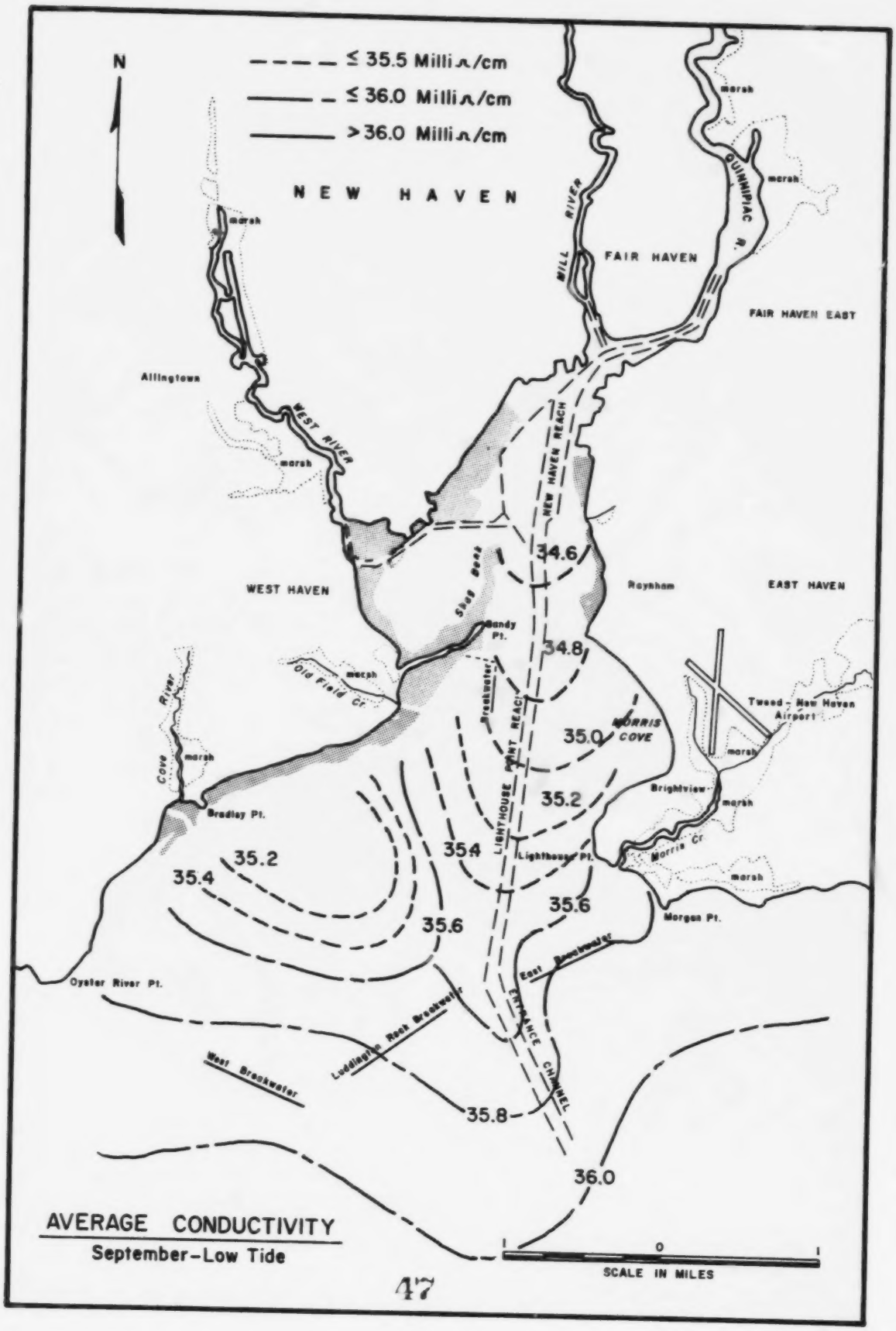
N
≤ 35.5 Millimhos/cm
≤ 36.0 Millimhos/cm
> 36.0 Millimhos/cm
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
EAST HAVEN
WEST HAVEN
Allingtown
Raynham
Tweed - New Haven Airport
MILL RIVER
QUINNIPIAC R.
WEST RIVER
NEW HAVEN REACH
LIGHTHOUSE POINT REACH
MORRIS COVE
Sandy Pt.
Old Field Cr.
Cove River
Bradley Pt.
Brightview
Morris Cr.
Lighthouse Pt.
Morgan Pt.
Oyster River Pt.
East Breakwater
Breakwater
Luddington Rock Breakwater
West Breakwater
ENTRANCE CHANNEL
marsh
34.6
34.8
35.0
35.2
35.4
35.6
35.8
36.0
AVERAGE CONDUCTIVITY
September–Low Tide
0
1
SCALE IN MILES

FIGURE 17

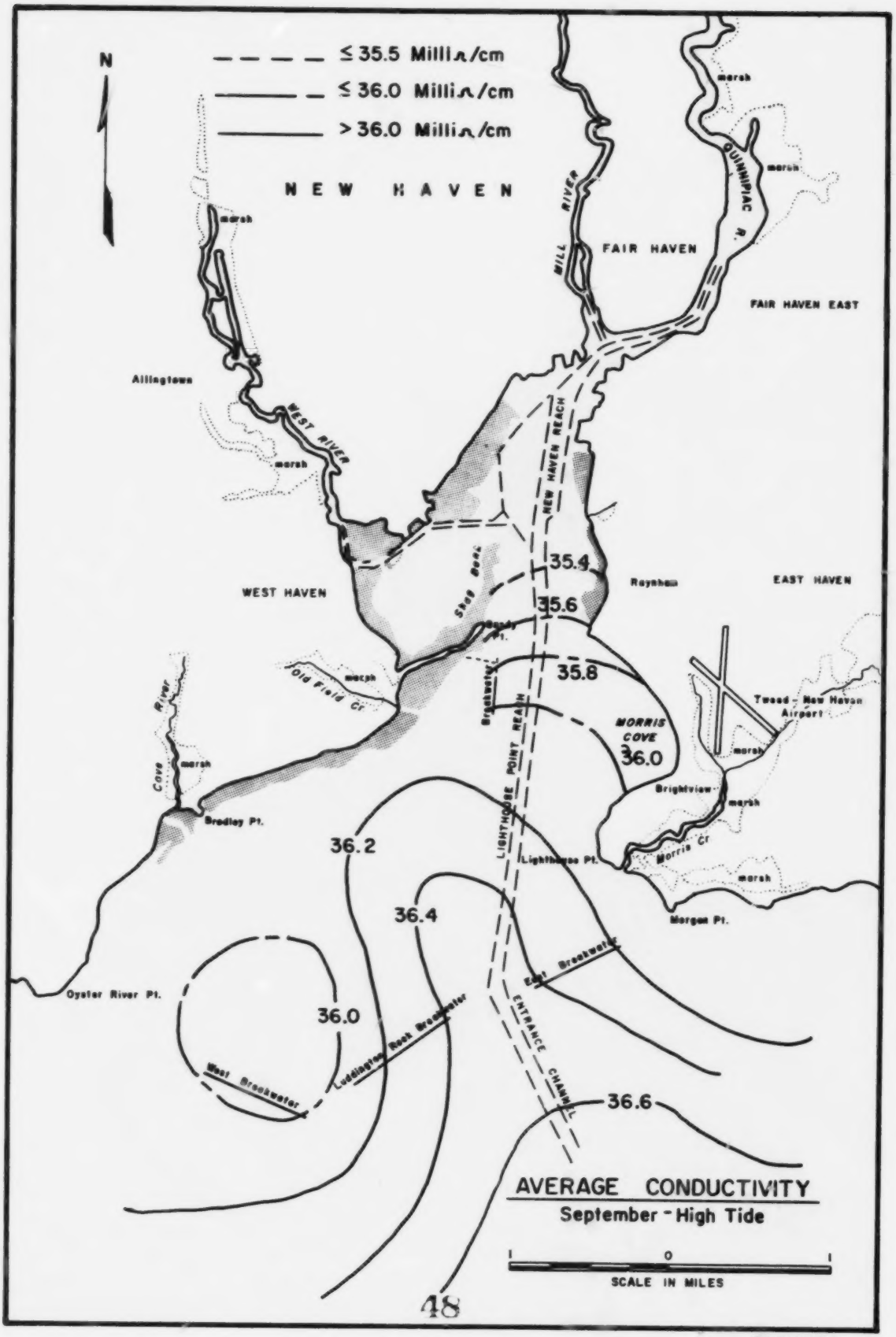
N
≤ 35.5 Millimhos/cm
≤ 36.0 Millimhos/cm
> 36.0 Millimhos/cm
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
EAST HAVEN
WEST HAVEN
Allingtown
Raynham
Tweed - New Haven Airport
Brightview
Morgan Pt.
Lighthouse Pt.
Bradley Pt.
Oyster River Pt.
Quinnipiac R.
Mill River
West River
Cove River
Old Field Cr
Morris Cr
Stony Creek
NEW HAVEN REACH
LIGHTHOUSE POINT REACH
ENTRANCE CHANNEL
MORRIS COVE
East Breakwater
West Breakwater
Luddington Rock Breakwater
marsh
35.4
35.6
35.8
36.0
36.2
36.4
36.6
AVERAGE CONDUCTIVITY
September - High Tide
1 0 1
SCALE IN MILES

FIGURE 18

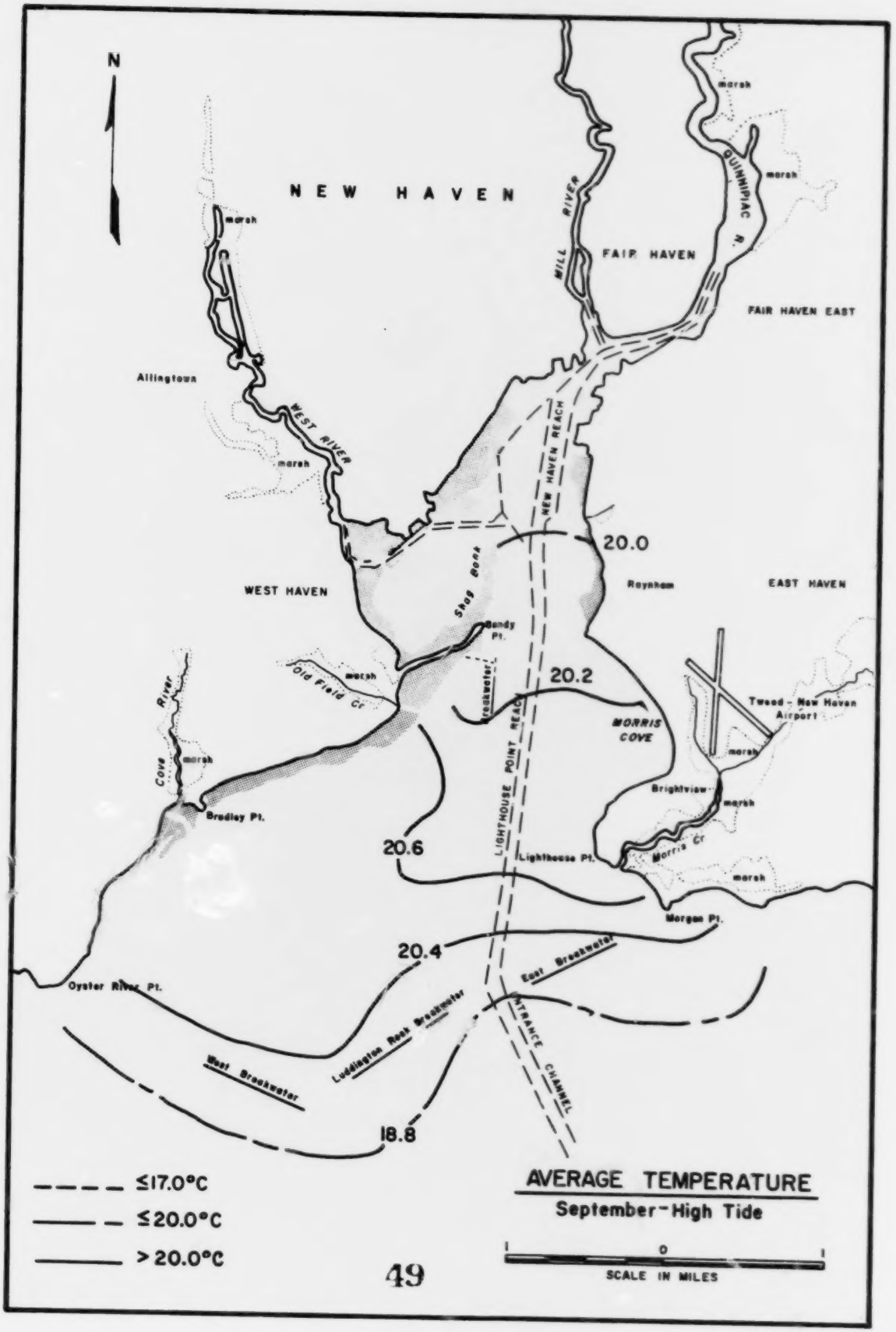
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
EAST HAVEN
WEST HAVEN
Allingtown
Reynham
Tweed - New Haven Airport
Brightview
Lighthouse Pt.
Morgan Pt.
Bradley Pt.
Oyster River Pt.
Sandy Pt.
Cove River
Old Field Cr
Morris Cr
MORRIS COVE
WEST RIVER
MILL RIVER
QUINNIPIAC R.
NEW HAVEN REACH
LIGHTHOUSE POINT REACH
ENTRANCE CHANNEL
Shag Rock
East Breakwater
Luddington Rock Breakwater
West Breakwater
marsh
20.0
20.2
20.4
20.6
18.8
≤17.0°C
≤20.0°C
>20.0°C
AVERAGE TEMPERATURE
September - High Tide
0
1
SCALE IN MILES

FIGURE 19

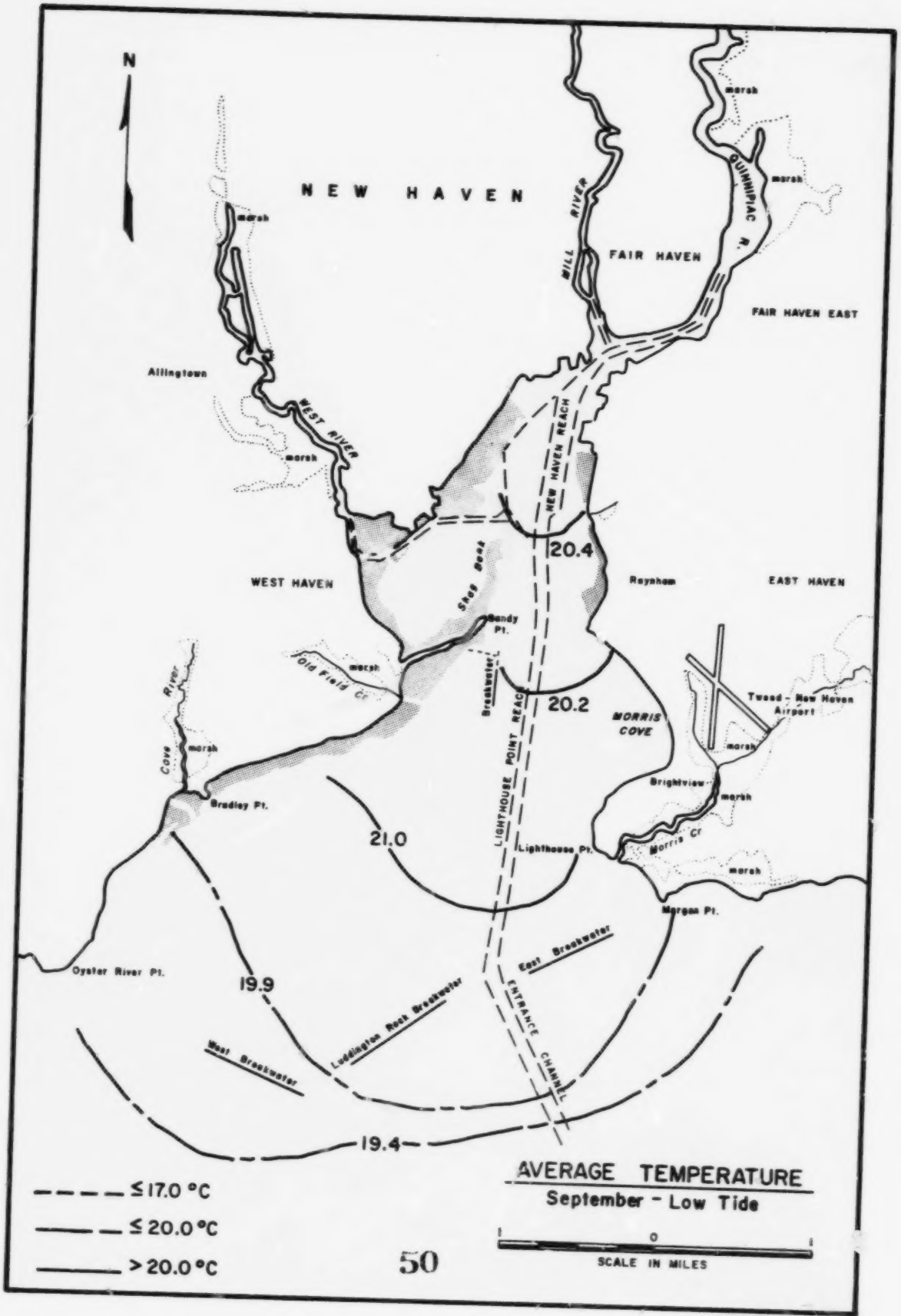
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
Allingtown
WEST HAVEN
Raynham
EAST HAVEN
MILL RIVER
QUINNIPIAC R.
WEST RIVER
NEW HAVEN REACH
LIGHTHOUSE POINT REACH
ENTRANCE CHANNEL
Shag Rock
Sandy Pt.
Old Field Cr.
Cove River
Bradley Pt.
Breakwater
MORRIS COVE
Tweed - New Haven Airport
Brightview
Morris Cr.
Lighthouse Pt.
Morgan Pt.
Oyster River Pt.
East Breakwater
Luddington Rock Breakwater
West Breakwater
marsh
20.4
20.2
21.0
19.9
19.4
≤17.0 °C
≤20.0 °C
>20.0 °C
AVERAGE TEMPERATURE
September - Low Tide
0
1
SCALE IN MILES

FIGURE 20

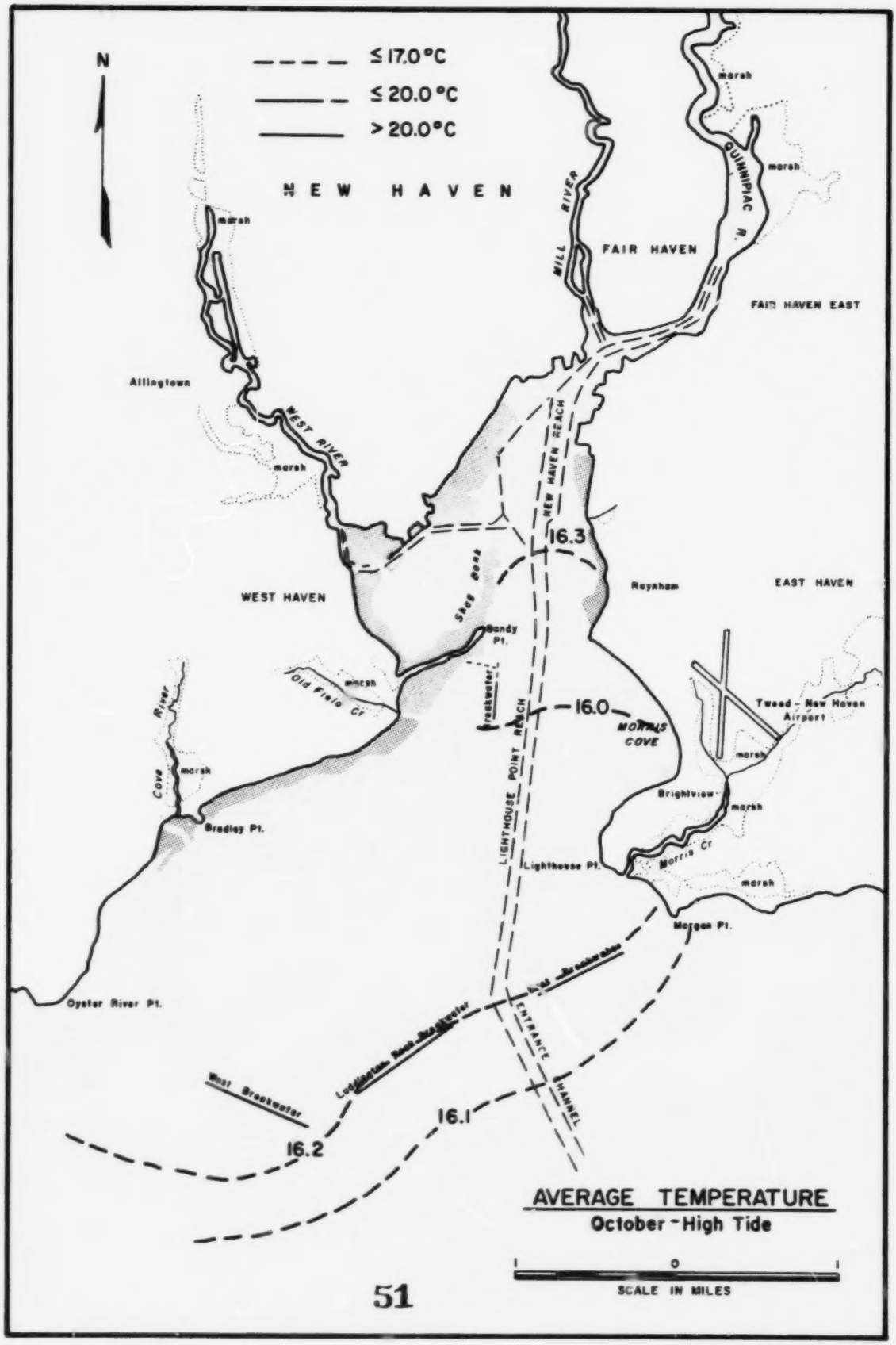
N
≤17.0°C
≤20.0°C
>20.0°C
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
EAST HAVEN
WEST HAVEN
Allingtown
Rowhom
Tweed - New Haven Airport
Bradley Pt.
Oyster River Pt.
Lighthouse Pt.
Morgan Pt.
Sandy Pt.
BrigMview
Morris Cr
Old Field Cr
Cove River
WEST RIVER
MILL RIVER
QUINNIPIAC R.
NEW HAVEN REACH
LIGHTHOUSE POINT REACH
MORRIS COVE
Freshwater
Shoal area
ENTRANCE CHANNEL
West Breakwater
16.3
16.0
16.1
16.2
marsh
AVERAGE TEMPERATURE
October - High Tide
1 0 1
SCALE IN MILES

FIGURE 21

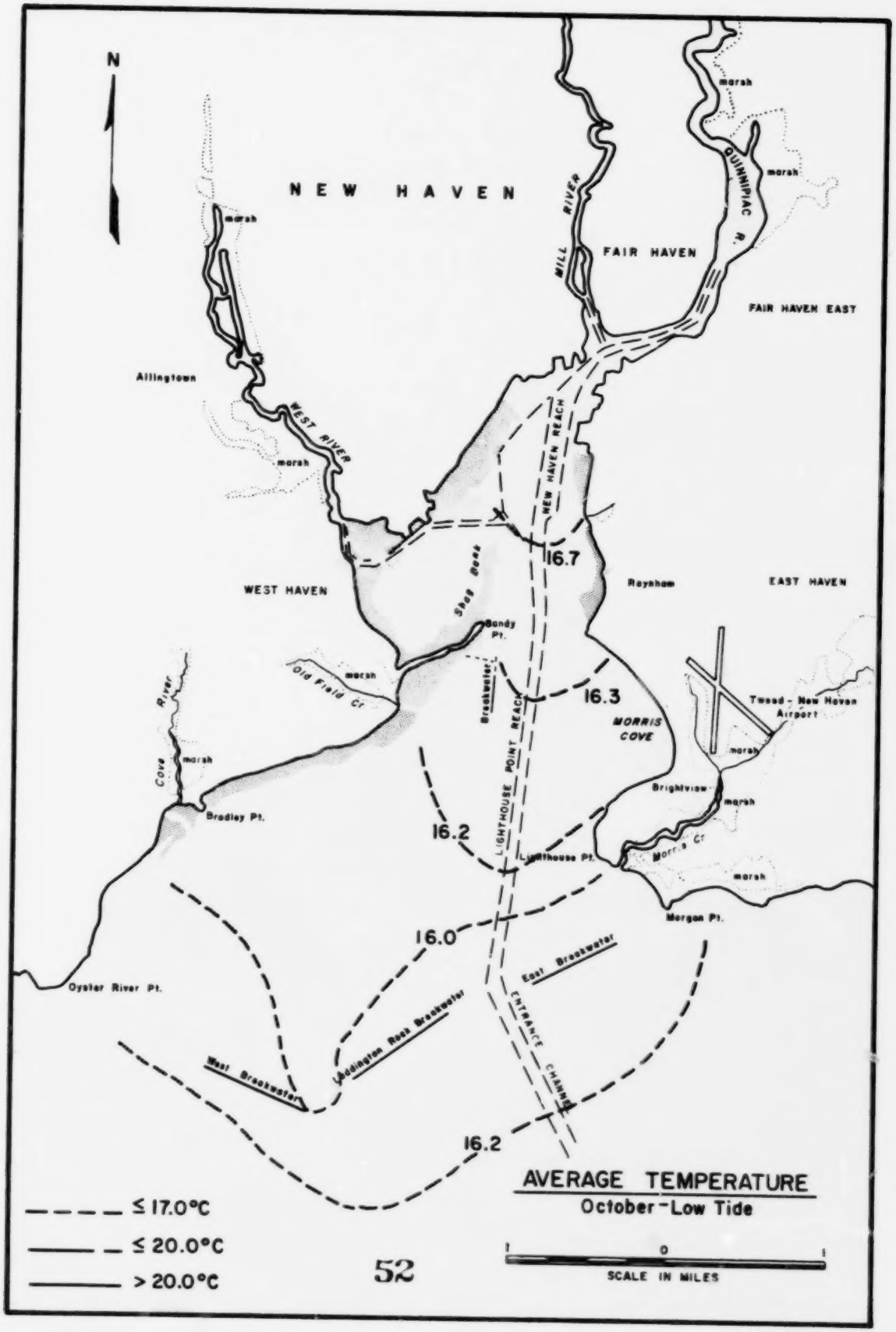
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
Allingtown
WEST HAVEN
Raynham
EAST HAVEN
MORRIS COVE
Bradley Pt.
Oyster River Pt.
Lighthouse Pt.
Morgan Pt.
Brightview
Tweed - New Haven Airport
Sandy Pt.
Old Field Cr.
Morris Cr.
Cove River
West River
Mill River
Quinnipiac R.
New Haven Reach
Lighthouse Point Reach
Entrance Channel
East Breakwater
Laddington Rock Breakwater
West Breakwater
Breakwater
Shoal Area
marsh
16.7
16.3
16.2
16.0
16.2
AVERAGE TEMPERATURE
October - Low Tide
≤ 17.0°C
≤ 20.0°C
> 20.0°C
1 0 1
SCALE IN MILES

FIGURE 22

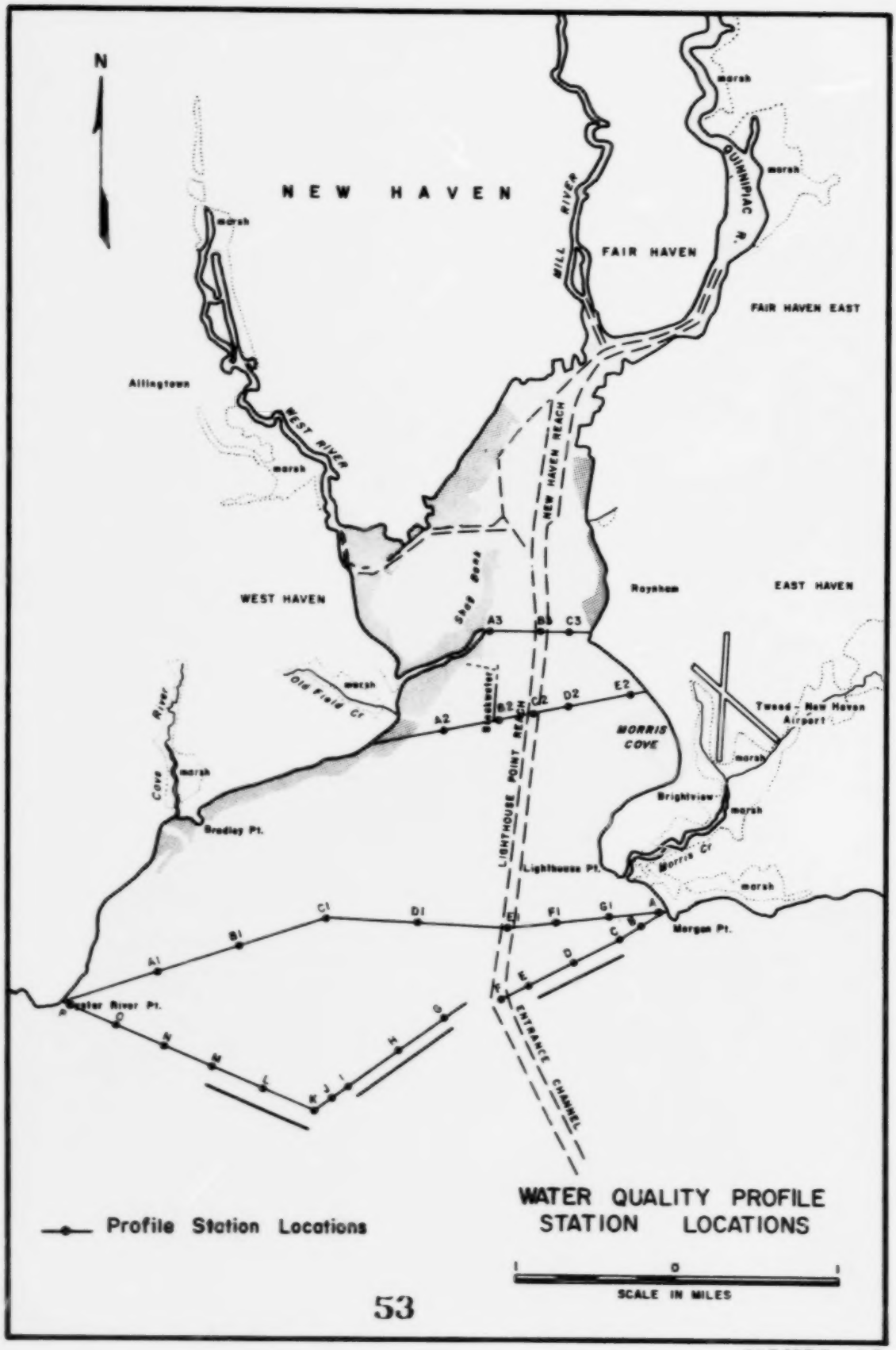
N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
Allingtown
WEST HAVEN
Raynham
EAST HAVEN
MILL RIVER
QUINNIPIAC R.
WEST RIVER
NEW HAVEN REACH
LIGHTHOUSE POINT REACH
MORRIS COVE
Old Field Cr
Cove River
Bradley Pt.
Lighthouse Pt.
Morris Cr
Brightview
Tweed - New Haven Airport
Morgan Pt.
Oyster River Pt.
ENTRANCE CHANNEL
marsh
A1
B1
C1
D1
E1
F1
G1
A2
B2
C2
D2
E2
A3
B3
C3
Profile Station Locations
WATER QUALITY PROFILE
STATION LOCATIONS
1 0 1
SCALE IN MILES

FIGURE 23

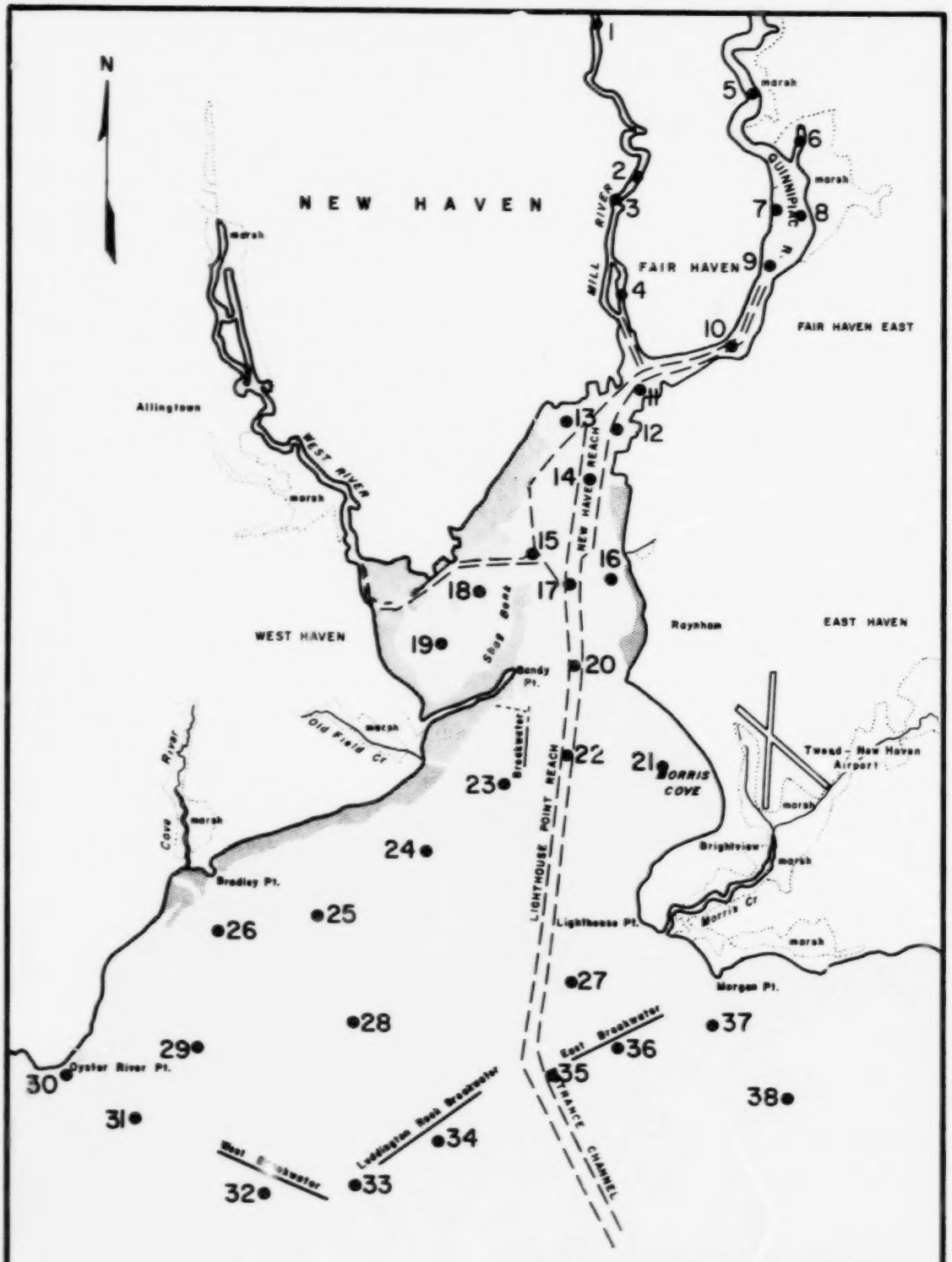

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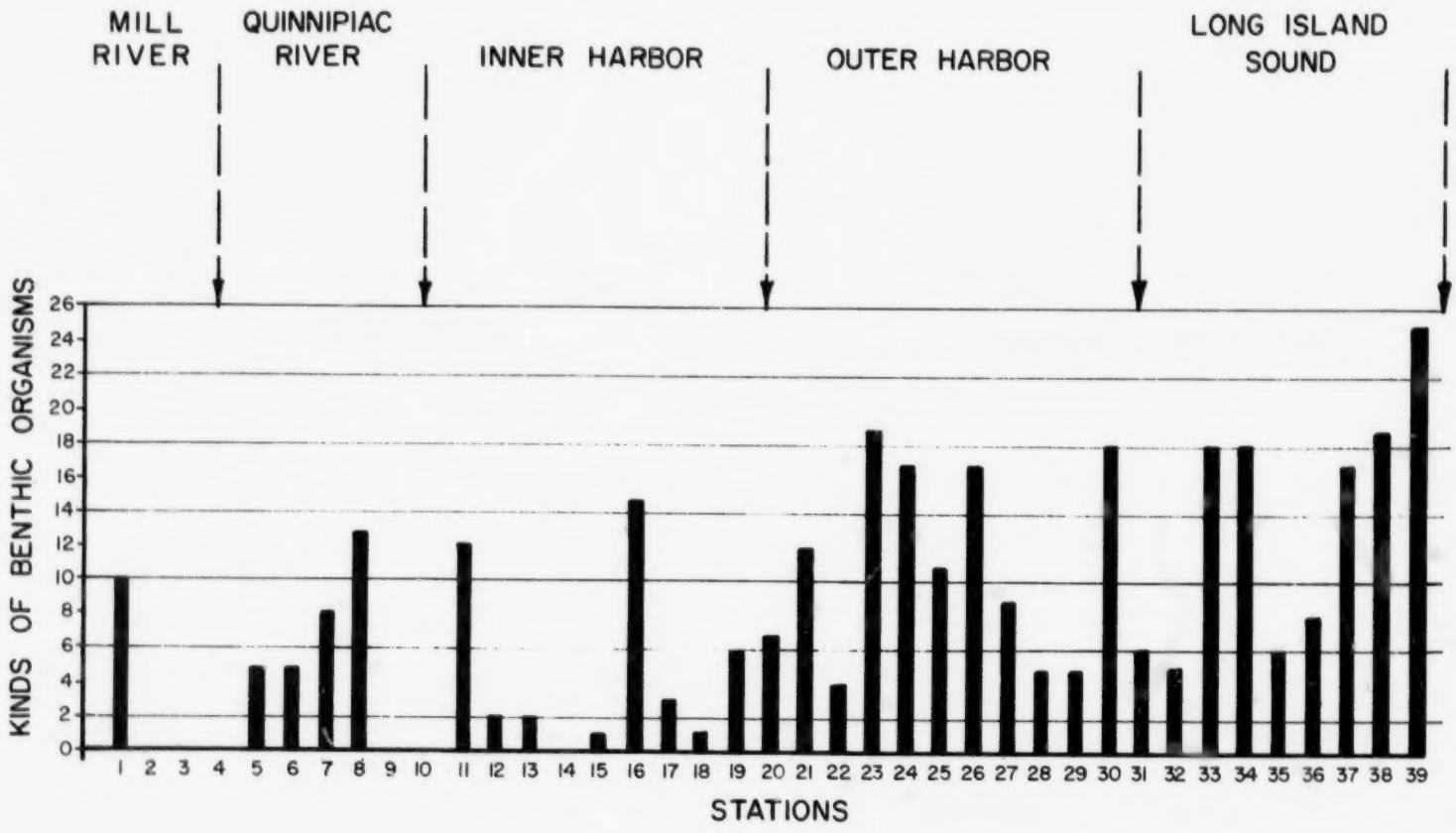
FIGURE 24



NEW HAVEN HARBOR AND TRIBUTARIES - 1967

KINDS OF ORGANISMS PER STATION

FIGURE 25

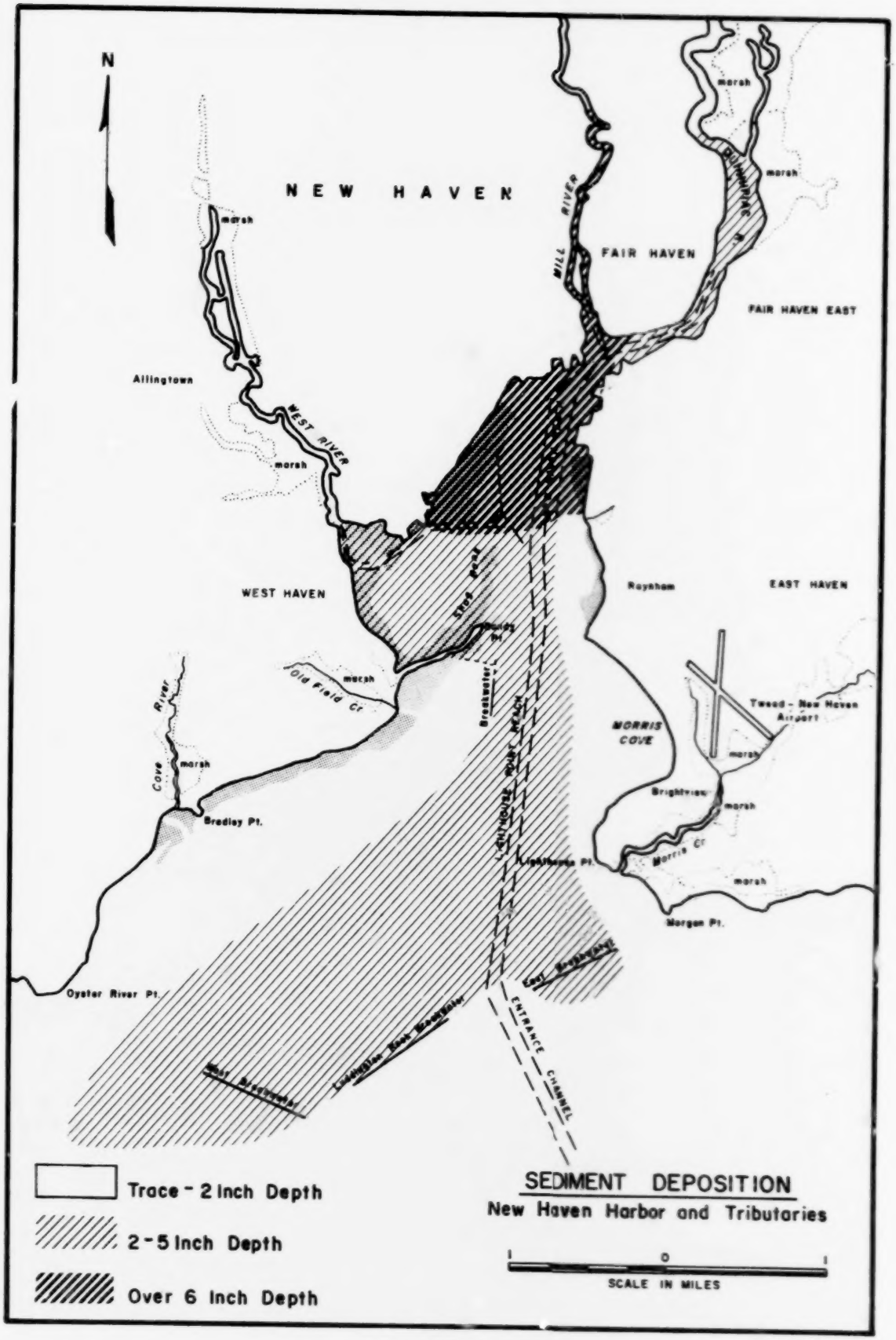

N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
WEST HAVEN
EAST HAVEN
Allingtown
Raynham
MORRIS COVE
Tweed - New Haven Airport
Brightview
Bradley Pt.
Oyster River Pt.
Lighthouse Pt.
Morgan Pt.
Morris Cr
Old Field Cr
Cove River
Breakwater
WEST RIVER
MILL RIVER
morsh
Trace - 2 Inch Depth
2 - 5 Inch Depth
Over 6 Inch Depth
SEDIMENT DEPOSITION
New Haven Harbor and Tributaries
SCALE IN MILES

FIGURE 26

SHELLFISH RESOURCE

GENERAL

All coastal wetlands are part of a complex ecological system contributing to a wide variety of fish and wildlife. The shellfisheries with which we are concerned comprise a part of such a system, requiring a delicate balance in the physical and biological characteristics of the environment in order to insure full growth and continuous development. The variation of any one or a number of factors in the environment, however, may be sufficiently critical to affect the growth and reproduction of the shellfish. Connecticut, at one time, was gifted with natural conditions which enabled it to become one of the most prolific shellfisheries in the world.

HISTORY

The Fifth Annual Report of the Bureau of Labor Statistics of the State of Connecticut reported in 1889 that..."nearly all of the legally available grounds for oyster planting in the rivers, harbors and bays have been designated, or deeded to private ownership, and in addition, we have a great system of more or less productive deep water oyster farms stretching for miles from the shores in an almost unbroken line from Greenwich to Branford." The report further stated that planting began in 1870 offshore in 30 feet of water outside of the Norwalk Islands, and was followed a few years later by deep water planting outside of New Haven Harbor. The export trade in oysters began about 1872.

Examples of shipments from New York to Europe are shown below:

Year	Liverpool, England	Various	Total in barrels
1883 - 4	67,520	3,500	71,020
1884 - 5	96,517	2,285	98,802
1885 - 6	93,385	2,512	95,897
1886 - 7	98,655	2,250	100,905
1887 - 8	95,994	3,129	99,123
1888 - 9	96,540	6,569	103,109

At least two-thirds and probably three-fourths of the shipments during 1888 and 1889 were Long Island oysters raised in Connecticut waters. The price paid to Connecticut cultivators in 1888 to 1889 was three dollars per barrel.

The Connecticut Shell Fish Commission, a state-supported agency established in 1881, has estimated that at the turn of the century production was over three million bushels of mature and seed oysters annually. Environmental changes in the coastal areas has brought a decline in shellfish production at a cost of over one billion dollars during the past sixty-five years.

Early records dating back to 1889, show that New Haven had, by far, the largest oyster business among the coastal towns and cities. At that time, it had a capital of $1,584,405, with 201 owners, 648 employees and $164,548 paid in wages. There were 162 vessels, all of which were working over an area totaling 36,476 acres.

SHELLFISH CONTROL

Shellfish Commission: Harvesting and the sale of shellfish in Connecticut are controlled by the State Department of Health, the State Shell Fish Commission and, to a lesser extent, the local town

governments. Connecticut statutes provide that no shellfish shall be sold for food unless taken from areas certified by the State Department of Health. All commercial harvesters and shippers must register and obtain from the State Department of Health a certificate to carry on a shellfish business. The state is responsible for all shellfish transplants from polluted waters to clean waters; the construction, operation and inspection of shellfish shucking plants; the control over wet storage of shellfish; and the packing and sale of shellfish. The use of chemicals over shellfish beds for predator eradication is under the jurisdiction of the State Board of Pesticide Control in consultation with the State Department of Health, Board of Fisheries and Game, and the State Shell Fish Commission. Shellfish areas closed for direct harvesting are patrolled by the local police under the supervision of the State Department of Health and the State Shell Fish Commission.

The Connecticut State Shell Fish Commission was established in 1881 under statutory authority to exercise control of all state shellfisheries and the shellfisheries of Westport, Milford, West Haven and New Haven as prescribed by law. This Commission is comprised of four commissioners and a chairman, all of whom are appointed by the Governor with the advice and consent of the Senate for four-year terms, respectively.

The Commission serves the public and shellfish industry in the administration of approximately 46,000 acres of franchised, leased and public grounds. It supervises all activities and establishes

policy relating to the leasing of grounds, approval of transfers, collection of rentals and taxes, issuing licenses, designation of spawning areas, reviewing permits for dredging or construction within tidal waters and directing a volunteer unit of 34 shellfish policemen. All records of titles, tax lists and detailed maps of private and public oyster grounds are available and kept at the State Shell Fish Commission office in Milford, Connecticut.

Local authorities regulate the natural shellfish beds under their control, including the right to harvest shellfish for sport or for commercial use. Most towns govern their own shellfisheries through local shellfish commissions.

Leasing of Shellfish Grounds: The Shell Fish Commission is entrusted with the exclusive jurisdiction and control of all state shellfisheries of West Haven and New Haven, as prescribed by law. Shellfish grounds are divided into three classifications: franchised, leased and public or natural grounds. In the case of New Haven Harbor, all shellfish beds are under the jurisdiction of the Shell Fish Commission as previously indicated.

Franchised grounds are beds in which perpetual rights are obtained by holders who do not necessarily own the grounds but may, at times, assign the perpetual rights to successive owners, as with real property. Franchised grounds, however, are no longer conferred by the Commission. Records show that the last grounds allocated in this manner were given by the Commission in 1915. Sixty percent of the grounds along the Connecticut shores are in this classification.

The direct leasing of grounds is the method for acquiring shellfish grounds since 1915. Grounds are open to public bids and the highest bidder is given the right to lease the grounds for a minimum of three years and a maximum of ten years with an option for renewal. The minimum acceptable bid is fifty cents per acre per year; however, certain grounds have run as high as twenty-five dollars per acre per year.

Natural beds, or public grounds, are those available to the public under a boat license or a personal license issued locally. Community shellfish beds are available to the public with certain residency requirements. In some local areas a permit may or may not be required, depending on the respective rulings of the towns.

Shellfish Ground Listing and Acreage: Town grounds under state jurisdiction: There are 179 individually-staked lots of leased shellfish grounds totaling 1,709 acres in the New Haven estuary under this classification. The lots are currently held by 27 individual owners:

	LOTS	ACRES
New Haven town	61	1,073
West River	2	3
Mill River	5	3
Quinnipiac River (West)	26	35
Quinnipiac River (East)	26	48
West Haven town	49	547
TOTALS	179	1,709

State Grounds: The following tabulation are grounds held under perpetual franchise by thirteen owners. The total area is 6,054 acres:

	LOTS	ACRES
East Haven	15	1,021
New Haven	17	1,822
West Haven	44	3,211
TOTALS	76	6,054

As of: January 1, 1966 New Haven and West Haven included 1,772 acres of leased grounds owned by 23 owners.

	LOTS	ACRES
New Haven	16	371
West Haven	48	1,901
TOTALS	64	2,272
GRAND TOTALS	319	10,035

SHELLFISH POPULATIONS

A shellfish population and potential market survey in New Haven Harbor was made with the assistance of the major New Haven producers and a marine biologist of the U.S. Fish and Wildlife Service. Within the last two decades, at least 12 major oyster firms have liquidated their assets and gone out of business. During the past two years, only two certificates were granted for harvesting and transplanting shellfish in New Haven.

The impact of pollution from domestic and industrial waste discharges, particularly in the Inner Harbor, has affected the shellfish industry. The shellfish grounds lying north of the breakwaters are closed by the State Department of Health to direct harvesting of shellfish. Seed shellfish in the closure areas may, under the supervision

of the State Department of Health, be transplanted into the open areas beyond the breakwaters for natural self-purification. No shellfish may be removed from these areas for marketing without prior permission from the Connecticut Health Department. Shellfish beds, as shown in Figure 27, are based on 1967 data provided by the Connecticut State Shell Fish Commission.

The tidal flats from the Grand Avenue Bridge northerly in the Quinnipiac River provides a naturally protected oyster transplant area. For many years this area has been used by the shellfish industry for the culturing of seed oysters. There are some soft-shelled clams in the intertidal zones on the east banks of the Quinnipiac River, in an area located between Grand Avenue Bridge and Middletown Avenue Bridge. No assessments have been made of these shellfish. Estimates showed that there are about 9,500 bushels of young oysters, not yet of market size, in an area north of the Grand Avenue Bridge. South of the Tomlinson Bridge in the so-called Inner Harbor, there are about 20,000 bushels of seed oysters. This area is considered to be a good and productive area for cultivating seed. In the Savin Rock area, inside the breakwaters, estimates place the number of seed at 47,000 bushels and marketable oysters at about 10,000 bushels. Local dealers consider this area to be one of the best suited for producing a shellfish with firm meat, natural color and a hard shell. The lighthouse area outside of Morris Creek is considered to be the best "setting" area in the harbor. There are about 20,000 bushels of seed oysters planted there in several lots. The Shell Fish Commission has planted mature

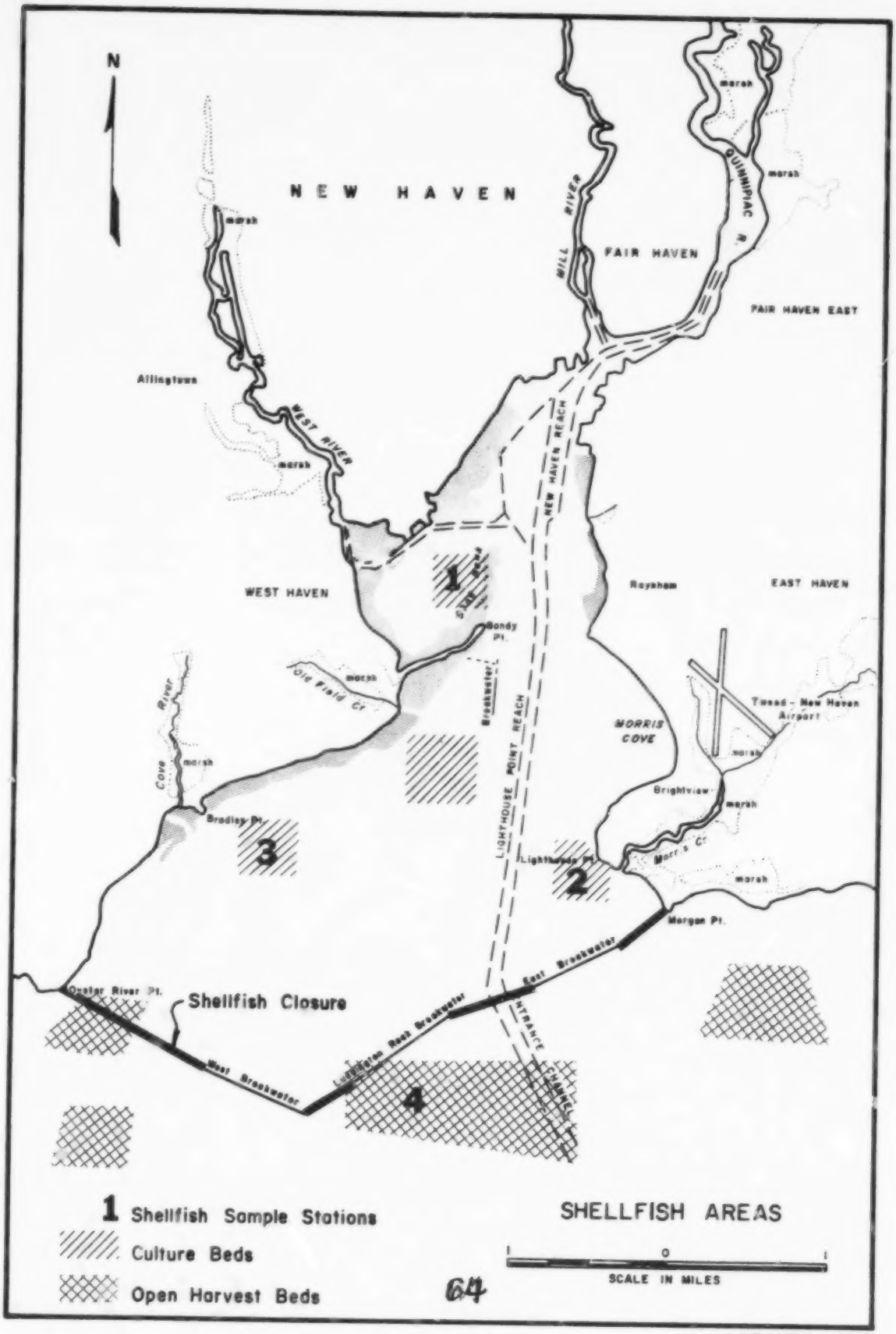

N
NEW HAVEN
FAIR HAVEN
FAIR HAVEN EAST
WEST HAVEN
EAST HAVEN
Allingtown
Roynham
marsh
WEST RIVER
MILL RIVER
QUINNIPIAC R.
NEW HAVEN REACH
LIGHTHOUSE POINT REACH
Oyster River
Cove River
Cove Field Cr.
Bradley Pt.
Sandy Pt.
Breakwater
MORRIS COVE
Tweed - New Haven Airport
Brightview
Morris Cr.
Lighthouse Pt.
Morgan Pt.
East Breakwater
Oyster River Pt.
Shellfish Closure
West Breakwater
Lighthouse Point Breakwater
ENTRANCE CHANNEL
1
2
3
4
1 Shellfish Sample Stations
Culture Beds
Open Harvest Beds
SHELLFISH AREAS
1 0 1
SCALE IN MILES

FIGURE 27

oysters in an area off Morris Creek in an attempt to determine the effects of water temperature changes which might affect the spawning mechanism of the shellfish. No assessments were made to determine the population of this experimental project.

On open shellfish beds located beyond the breakwaters, estimates showed that there are about 146,000 bushels of seed located in several individually cultivated grounds. These oysters are of various sizes and ages. Some are one-year old seedlings, while certain amounts are larger and will be ready for marketing within the next few years.

Studies conducted by the Shell Fish Commission indicated that the yield of the shellfish from the culturing stage to the marketable leve. in this particular area is at the rate of about four to one. Generally, one bushel of seed oyster will ultimately "bulk" and provide another four bushels of marketable size oysters within three to four and one-half years.

Market prices in 1967 place the value of seed oysters in a range from $4.00 a bushel for natural sets against $10.00 a bushel for artificially propagated sets. At the time, market oysters were selling at $16.00 per bushel. Estimates showed that the harbor crop of immature oyster population (non-marketable) at a market price of $4.00 per bushel, is worth about $1,002,000 based on natural sets. This figure represents a standing crop of unharvested seed oysters. In three to four years the shellfish potential yield from this crop when sold upon maturity under a market price of $16.00 per bushel, will carry a value of $16,032,000. A 20% loss deduction can be taken

from this amount due to shellfish mortalities from transplant operations and predators, leaving a potential of $12,826,000 (Table 17).

SAMPLING OF SHELLFISH

This study included four stations selected for examining bacteriological and metal levels in shellfish. One sample station (Number 1) is in the Inner Harbor south of City Point, adjacent to the New Haven and West Haven town line. Two other stations (Numbers 2 and 3) are located in the Outer Harbor areas, at Lighthouse Point and Bradley Point, respectively. The final station (Number 4) is located just south of the Ludington Breakwaters. The shellfish were collected and delivered to the Department of Health, Education and Welfare, Public Health Service, Northeast Marine Health Sciences Laboratory at Narragansett, Rhode Island, for analyses.

The National Shellfish Sanitation Program requires periodic examination and evaluation of water quality data of shellfish areas by the states for area classifications. The 1964 National Shellfish Sanitation Workshop adopted the following standards as being applicable to all species of fresh and frozen oysters at the wholesale market level. Satisfactory: fecal coliform density of not more than 230 MPN per 100 grams; and a total plate count taken at 35°C of not more than 500,000 colonies per gram will be acceptable without question.

Bacteriological results of four samples of oysters taken from New Haven Harbor showed that two samples met the above standards. Stations 3 (closed area) and 4 (open area) both received satisfactory bacterial counts of fecal coliform density of 45 MPN and

TABLE 17

SHELLFISH POPULATION ESTIMATES AND VALUES FOR 1967

Open Areas	Present Crop (seed and mature)			Potential Yield (mature	
Location	Seed No. Bushels	Mature Bushels	$4/bu in dollars	Growth 4 to 1 ratio in bushels	$16/bu in dollars
Outside breakwaters*	20,000		80,000	80,000	1,280,000
" "	6,000		24,000	24,000	384,000
	120,000		480,000	480,000	7,680,000
TOTALS	146,000		584,000	584,000	9,344,000
Closed Areas					
Inner Harbor	28,000		112,000	112,000	1,792,000
Quinnipiac R.	9,500		38,000	38,000	608,000
Outer Harbor, W.	47,000		188,000	188,000	3,008,000
Outer Harbor, W.	--	10,000	160,000	--	--
Outer Harbor, E.	20,000		80,000	80,000	1,280,000
TOTALS	104,500	10,000	578,000	418,000	6,688,000
GRAND TOTAL	250,500	10,000	1,162,000	1,002,000	16,032,000+ (less 20%) 12,826,000

*See Figure 27.

+Subject to predators and transplant operations.

78 MPN, per 100 grams, respectively. Stations 1 and 2, in closed shellfish areas, did not attain satisfactory bacterial counts. Fecal coliform density for Station 1 was 1300 MPN and the fecal coliform density for Station 2 was 330 MPN per 100 grams, respectively.

Results of bacteriological examinations of four samples of oysters from New Haven Harbor are as follows:

Station No.	Coliform MPN/100 G.	Fecal Coliform MPN/100 G.
1 (closed)	17,000	1,300
2 (closed)	1,100	330
3 (closed	330	45
4 (open)	460	78

Samples of oysters were sent to the Northeast Marine Health Sciences Laboratory, USPHS, Narragansett, Rhode Island, for analyses in determining levels of metals in shellfish tissues. The tissue results were matched against the reference standards (following chart) provided by Drs. Benjamin H. Pringle and Carl N. Shuster, Jr. of the above laboratory and data from other scientists. The reference standards data show an average reading and a range of metal levels found in shellfish from Maine to North Carolina. Data from the other group show their average levels or no data for a particular metal.

A comparison of the metal content (see Table 18) in the sampled oysters with the reference standards show that results of all the sampled shellfish fall within the standard range. Five of the metals; Cr, Cu, Fe, Pb and Zn; exceeded the average levels of the reference standards. Two metals, Fe and Zn, exceeded when compared with findings by another research group (McFarren, et al, 1926).

TABLE 18

METAL CONTENT IN OYSTERS (*Crassostrea virginica*) in ppm

Trace Metal	+**Ranges of Reference Standards	Average Reference Standards	Ranges of Oyster Samples Stations 1-4	xRange of Average Readings by Other Scientists Using Other Analytical Methods
Cd	0.10 - 7.80	3.10	1.493 - 2.045	no data
Cr	0.04 - 3.40	0.40	0.404 - 0.646	no data
Co	0.06 - 0.20	0.10	0	no data
Cu	7.0 - 517.0	91.50	84.90 - 116.03	78.5 - 230
Fe	31.0 - 238.0	67.0	51.89 - 116.03	34.8 - 57.0
Pb	0.10 - 2.30	0.47	0.0 - 1.154	no data
Mn	0.14 - 15.0	4.30	0.0 - 2.780	2.3 - 3.7
Ni	0.08 - 1.80	0.19	0	no data
Zn	180 - 4120.0	1420	1605.17 - 2471.40	1018 - 1641

*"A Guide to Trace Metal Levels in Shellfish," Northeast Marine Health Sciences Laboratory, Narragansett, Rhode Island, Benjamin H. Pringle and Carl Shuster, Jr., December 1967.

+ Trace Metal values are given in ppm of shellfish wet tissue weights via atomic absorption oysters from Atlantic Coast waters--Maine through North Carolina.

x McFarren, et al (1962): New Hampshire through North Carolina (1960 data).

Dry weight data (divided by 5) of Caltsoff (1964): Long Island Sound (1933-35)

Dry weight data (divided by 5) of Chipman, et al 1958: Connecticut through Georgia

Coulsen, et al (1932): Rhode Island through New Jersey (1931 data).

DISCUSSION

At the turn of the century Connecticut's shellfish industry had a production rate estimated at three million bushels annually, serving many ports in England and the European continent. New Haven Harbor had one of the largest oyster businesses and was managed by 201 owners. Presently, only a fraction of the original shellfish dealers are in the business today.

The harvesting, sale and shipping of shellfish are under the supervision of the State Department of Health, while the administration of all shellfish grounds and the community grounds of New Haven, West Haven, Milford and Westport come under the State Shell Fish Commission. Local authorities are responsible for shellfish grounds in their communities. New Haven Harbor covers about eight nautical square miles, containing 319 individual shellfish beds amounting to about 10,000 acres. There are also 255 lots and about 7,760 acres of State and town grounds resulting in a grand total of 574 lots and 17,800 acres for the estuary.

Commercial shellfish in the harbor consist entirely of the eastern oyster (Crassostrea virginica). Portions of the Quinnipiac River above the Grand Avenue Bridge are used for spawning. Both the Inner and Outer Harbors are utilized for oyster spawning and cultivating in preparation for transplanting and marketing. Estimates indicate that there are about 250,500 bushels of seed oysters and 10,000 market oysters valued at $1,162,000. As this crop matures to market potential, its production is in the order of 1,002,000 bushels with a value placed at $12,826,000.

Samplings of oysters at four locations in the harbor showed that two had met the satisfactory standards for oyster meats established by the National Shellfish Sanitation Program. One station located in the open shellfish areas had a fecal coliform density of 78 MPN/100 G, while the other sample, taken inside the breakwaters in the closed area, had a count of 45.

Metal levels found in the oyster samples fall within the ranges established by the research of Drs. Pringle and Shuster, Jr. in their determination of metal contents in shellfish taken from Maine to North Carolina. However, five metals exceeded the average reference standard, and two of the above five metals exceeded average level standards established by other scientists.

Twelve major oyster companies located in and near New Haven have gone out of business within the last 20 years. State Shell Fish Commission records show that many shellfish beds located in the harbor and beyond the breakwaters are held under perpetual franchise and have not been active during the past years.

The Connecticut State Shell Fish Commission and the oyster industry in New Haven regard this estuary as one of the few remaining valuable oyster grounds in Connecticut. The area is not as large as other estuaries along the coast; however, its value in terms of shellfish production per unit area is greater than most others.

APPENDIX A

Waste Sources, Location and Characteristics

The location and characteristics of municipal and industrial waste discharges affecting New Haven Harbor are shown in Table 1. The legend immediately preceding the table explains the symbols utilized in the data presentation. The informatior shown was basically developed in 1967; however, more recent data has been incorporated where changes are known to have taken place. In addition, Figure 1 at the end of this report shows the location of the most significant waste discharges.

TABLE I

LOCATION AND ESTIMATED CHARACTERISTICS OF DOMESTIC AND INDUSTRIAL WASTES DISCHARGED TO NEW HAVEN HARBOR AND ITS TRIBUTARIES

SYMBOL	LEGEND DESCRIPTION
MS	Discharged to municipal sewer
x	Unknown quantity
NA	Not applicable
Water Used - Other	Primarily cooling water
C_s	Septic tanks
C	Settling tanks
I_u	Land underdrained
I_s	Sub-surface application
L	Lagoon
L_p	Lagoons for settling of sewage
F	Filters
F_s	Intermittent Sand Filters
E	Chlorination
D	Digester, separate sludge digestion
6	Filtration
7	Flotation
8	Neutralization
11	Waste prevention measures - good housekeeping

That column entitled "River Discharged To" denotes the final discharge point of the sanitary and industrial wastes, if known. If there is no industrial waste discharge from the plant and the sanitary waste is discharged to a municipal sewer, the information in this column indicates the river on which the industry is located.

The "Water Used" values presented are based primarily on 1961 data compiled by the Connecticut Water Resources Commission in their publication entitled "Waste Water Disposal by Connecticut Industries."

TABLE I

LOCATION AND ESTIMATED CHARACTERISTICS OF DOMESTIC AND INDUSTRIAL WASTES DISCHARGED TO NEW HAVEN HARBOR AND ITS TRIBUTARIES

SOURCE	RIVER DISCHARGED TO	PROCESS WASTE	WATER USED (000 gpd) Sanitary	Process	Other	SANITARY WASTE Treat./Disch. To		INDUSTRIAL WASTE Treat./Disch. To	
NEW HAVEN									
Acme Chromium Plating Co. (State St. Plant)	Mill River	Chrome, Nickel Copper, Zinc Alkalai Sulfuric Acid	0.30	54.09	NA		MS	NA	MS
Amer. Steel & Wire Div. of U. S. Steel	Quinnipiac River	Sulfuric Acid Lubricant Soap Hydrochloric Acid	11.25	125.0	146.44		MS	None NA	Stream MS
Conn. Co.	Mill River	Oil & Grit	2.40	22.32	0.28		MS	7	Stream
Conn. Coke Co.	New Haven Harbor	NA	4.00	NA	8681.0	None	Stream	NA	NA
Conn. Hard Rubber Co.	Mill River	NA	3.75	NA	98.25		MS	NA	NA
Federal Paper Board Co., Ic.	Mill River	Fiber Debris Chemicals Titanium Dioxide Starch Pigments Clays Glue	15.0	2696.5	248.5		MS	7 NA	Stream MS
Geometric Tool Co., Div. United Greenfield Corp.	West River	Soluble Oil Brine KPA	4.12	2.24	16.01		MS	Dry Well	Ground

TABLE I (Continued)

SOURCE	RIVER DISCHARGED TO	PROCESS WASTE	WATER USED (000 gpd) Sanitary	Process	Other	SANITARY WASTE Treat./Disch. To		INDUSTRIAL WASTE Treat./Disch. To	
Greist Mfg. Co. Div. of Mite Corp.	West River	Acids Stripping Comp. Stones Pumice Soluble Oils	9.0	15.0	1264.95		MS	None	Stream
Humble Oil & Refining	New Haven Harbor	NA	0.45	0.30	2.80	None	Stream	None	Harbor
Mite Corp.	New Haven Harbor	x	x	x	NA		MS	x	x
National Gypsum	Quinnipiac River	X	x	x	NA		MS	x	x
New Haven Bd. & Carton Co.	Mill River	Paper Fiber Titanium Dioxide Clay Alum Dye & Glue	11.0	1728.0	361.0	None	MS Stream	7	Stream
New Haven Gas Co.	Mill River	Oils Tars	0.90	x	234.5	None	Stream	6	Stream
New Haven Malleable Iron Co.	Quinnipiac River	NA	2.10	NA	3.58	None	River	NA	NA
N.Y., N.H. & H. R.R. Co., N.H. Motor Stor.	New Haven Harbor	Dirt	360.0	4.9	47.1		MS	None	Harbor

TABLE I (Continued)

SOURCE	RIVER DISCHARGED TO	PROCESS WASTE	WATER USED (000 gpd) Sanitary	Process	Other	SANITARY WASTE Treat./Disch. To		INDUSTRIAL WASTE Treat./Disch. To	
N.Y., N.H. & H. R.R., Cedar Hill Yards	Quinnipiac River	Dirt Oil	5.0	2.5	102.2	C_s	Stream	x	Stream
Seamless Rubber Co.	New Haven Harbor	Protein Sugar Color	12.4	27.36	298.94		MS	L	Ground
T.A.D. Jones & Co., Inc.	New Haven Harbor	Dirt	0.40	3.00	27.16	C_s	Harbor	None	Ground
Textron Electronics	Quinnipiac River	NA	x	x	NA		MS	x	x
Tidewater Oil Co.	New Haven Harbor	NA	0.41	NA	NA	C_s	Harbor	NA	NA
United Illuminating Co.	Quinnipiac River	NA	4.2	NA	5745.8	C_s	Stream	None	Stream
Wire Machinery Corp. of America	Stream	Soluble oil	0.52	0.98	NA	C_s	Stream	C_s	Stream
Wyatt Fuels	Ground	NA	0.83	NA	59.0	$C_s I_u$	MS Ground	None	Ground
Mansfield Oyster Co.	Quinnipiac River	Wash water	x	x	NA	x	x	x	Stream
Incinerator	Quinnipiac River	Ashes, Debris	x	x	x	x	x	x	x

TABLE I (Continued)

SOURCE	RIVER DISCHARGED TO	PROCESS WASTE	WATER USED (000 gpd) Sanitary	Process	Other	SANITARY WASTE Treat./Disch. To		INDUSTRIAL WASTE Treat./Disch. To	
Scrap Iron Yard	Quinnipiac River	Debris, Drainage	x	x	x	x	x	x	x
Lehigh Concrete	Quinnipiac River	Solids	x	x	x	x	x	x	x
Boulevard WPCF	New Haven Harbor	Wastewater	12,400	NA	NA	Primary	Harbor	NA	NA
East Shore WPCF	New Haven Harbor	Wastewater	4,800	NA	NA	Primary	Harbor	NA	NA
East Street WPCF	New Haven Harbor	Wastewater	10,000	NA	NA	Primary	Harbor	NA	NA
HAMDEN									
Botwinik Bros.	Ground	Soluble Oil	0.75	0.01	0.97		MS	Dry Well	Ground
C.W. Blakeslee & Sons, Inc.	Ground	Water, Sand & Cement	1.20	1.00	60.0		MS	Dry Well	Ground
Detroit Steel Corp., Eastern Div.	Ground	Sulfuric Acid Soluble Oil	2.48	150.67	6.85		MS	C & L	Ground
Eastern Ind., Div. Laboratory for Electronics	Shepard Brook	Oil, Kerosene Steel Chips	2.55	NA	7.45	C_sI_s	Ground	11	Ground
Geo. W. Fleming Co., Royal Brand Cutlery Co. Div.	Mill River	Soluble Oil	0.90	3.43	> .03	C_sI_u	Ground	CI_u	Ground

TABLE I (Continued)

SOURCE	RIVER DISCHARGED TO	PROCESS WASTE	WATER USED (000 gpd) Sanitary	Process	Other	SANITARY WASTE Treat./Disch. To		INDUSTRIAL WASTE Treat./Disch. To	
H.A. Leed Co.	Whitney Lake	Sulfuric Acid Alkalai	0.82	38.2	0.50		MS	None	Lake
Giering Metal Finishing, Inc.	Ground	Chromium, Acid	x	x	x	C_sI_s	Ground	x	Ground
High Standard Mfg. Co.	Whitney Lake	Blackening Anodizing, Ni.	10.5	33.5	79.21		MS	8	Lake
Himmel Bros. Co.	Whitney Lake	Water, Acid	1.2	60.0	0.75		MS	L_p	Lake
Pepsi Cola Bottling	Ground	Caustic	0.15	16.36	3.79	C_s	Ground	C_s	Ground
Safety Electric Equip. Corp.	Whitney Lake	NA	5.25	4.80	7.95		MS	None	Lake
Snow-Nabstedt Gear Corp.	Ground	Copper, Acid	1.35	53.53	6.02		MS	Dry Well	Ground
Whitney Blake Co.	Whitney Lake	Plastic Scrap Copper partic.	10.35	418.44	18.10		MS	None	Lake
Outfall #1	New Haven East Street WPCF	Wastewater	1190	NA	NA	Primary Harbor		NA	NA
Outfall #2	New Haven Boulevard WPCF	Wastewater	2460	NA	NA	Primary Harbor		NA	NA
Outfall #3	New Haven East Shore WPCF	Wastewater	770	NA	NA	Primary Harbor		NA	NA

TABLE I (Continued)

SOURCE	RIVER DISCHARGED TO	PROCESS WASTE	WATER USED (000 gpd) Sanitary	Process	Other	SANITARY WASTE Treat./Disch. To		INDUSTRIAL WASTE Treat./Disch. to	
NORTH HAVEN									
American Powdered Metals Inc.	Quinnipiac River	Cooling	1.72	NA	42.7	C_sI_s	Ground		
American Refractory & Crucible	Stream	Aluminum Oxide	2.03	8.68	2.94	C_sI_s	Ground	None	Stream
Aura Mfg. Co., Inc.	Little River	Chromic Acid chips Sulfuric Acid	0.45	0.01	1.55	C_sI_s	Ground	None	Stream
Branford Mfg. Co., Inc.	Little River	Apex cleaner Phosphate Lime Muriatic Acid Nitric Acid	0.98	0.21	1.13	C_sI_s	Ground	None	Stream
Burndy Corp.	Quinnipiac River	Sulfuric Acid Cyanide, Silver	3.15	x	1.25	C_sI_s	Ground	None	Stream
Carwin Co. (Upjohn Co.)	Quinnipiac River	Acids, Alkalai Organic Material	3.50	108.27	1027.5	C_s	Ground	L_p	Stream
Circuit Wire Inc.	Quinnipiac River	x	x	x	NA		MS	x	x
City Printing Co.	Quinnipiac River	x	x	x	NA		MS	x	x
Conn. Container Corp.	Quinnipiac River	Starch	1.20	x	4.34	C_sI_s	Ground	C	Stream

TABLE I (Continued)

SOURCE	RIVER DIS-CHARGED TO	PROCESS WASTE	WATER USED (000 gpd) Sanitary	Process	Other	SANITARY WASTE Treat./Disch. To		INDUSTRIAL WASTE Treat./Disch. To	
Drabkin Family Spray Trust	Quinnipiac River	x	x	x	NA		MS	x	Stream
Empire, Inc. DBA Empire Car Wash	Quinnipiac River	Dirt	x	x	NA		MS	x	MS
Humphrey Chemical Co.	Quinnipiac River	Acids	0.32	0.02	19.8	C_sI_s	Ground	None	Stream
Knudsen Bros. Dairy	Ground	Water, Caustic Detergent, Whey	3.24	988.56	6.60	C_s	Ground	F_s	Ground
Linde Co., Div. of Union Carbide Co.	Quinnipiac River	Lime Ferrous Silicone	0.33	1.00	7.67	C_sI_s	Ground	None	Stream
McDermott Steel Specialty Co.	Little River	Soluble Oils	0.33	0.02	NA	C_sI_s	Ground	None	Stream
D.F. Mossberg & Sons	Quinnipiac River	x	x	x	NA		MS	x	x
Platt Labonia Co.	Quinnipiac River	NA	0.63	4.85	NA	C_sI_s	Ground	None	Stream
Pratt Whitney Aircraft, NH Div.	Quinnipiac River	Chromium Nickel, Acids Cyanide	153	1456	631	C_sEFD	Stream	None	Stream
Stiles Brick Div. Plasticrete Corp.	Quinnipiac River	Silt	1.35	540.0	11.6	Cesspool	Ground	L_p	Stream

TABLE I (Continued)

SOURCE	RIVER DISCHARGED TO	PROCESS WASTE	WATER USED (000 gpd) Sanitary	Process	Other	SANITARY WASTE Treat./Disch. To		INDUSTRIAL WASTE Treat./Disch. To	
Vincent Buonogore & Sons	Quinnipiac River	x	x	x	NA	MS		x	x
North Haven S.T.P. (1966)	Quinnipiac River	Wastewater	325	NA	NA	Secondary Stream		NA	NA
EAST HAVEN									
C & F Cheese Distributors	Tuttle Branch	Water Skim milk	0.15	6.00	0.11	C_sI_u	Ground	None	Stream
East Haven Laundry	Ground	Detergent	0.06	x	x	C_sI_u	Ground	CI_u	Ground
Shoreline Packing & Abattoir Co. Inc.	Ground	Water Blood	0.11	x	NA	C_sI_u	Ground	C	Ground
Sewage Treat. Plant	1962 - none listed								
WEST HAVEN									
American Buckle Co.	Quinnipiac River	x	x	x	NA	MS		x	MS
Armstrong Rubber Co.	Quinnipiac River	x	x	x	NA	MS		x	x
Car Washers, Inc.	Quinnipiac River	x	x	x	NA	MS		x	x

TABLE I (Continued)

SOURCE	RIVER DISCHARGED TO	PROCESS WASTE	WATER USED (000 gpd) Sanitary	Process	Other	SANITARY WASTE Treat./Disch. To		INDUSTRIAL WASTE Treat./Disch. To	
Corenco Corp.	Quinnipiac River	x	x	x	NA		MS	x	x
Hamilton Mfg. Company, Inc.	Ground	Soluble Oils Water	1.05	0.04	5.43		MS	None	Ground
New Haven Rendering Co.	West River	Fat Dirt	1.10	27.5	3164.4	None	River	x	Stream
Newton, New Haven Company	Cove River	Alkalai, Acid Abrasive	2.79	5.22	1.79		MS	C_sI_u	Stream
West Haven S.T.P.	New Haven Harbor	Wastewater	3500.0	NA	NA	Secondary	Harbor	NA	NA
WALLINGFORD									
American Cyanamid Co.	Quinnipiac River	Ureaformaldehyde	22.5	14.4	3038.6	C_sI_s	Ground	None	Stream
International Silver Co. (M)	Stream, Ground Sewer	Soluble Oils Cooling	0.71	5.76	1.20		MS	NA 11	MS Ground
International Silver Co. (A)	Quinnipiac River	Acid, Cyanide Silver Soap Whale Oil, Cooling Hydrochloric Acid Nitric Acid, Caustic	19.5	325.0	180.5		MS	NA	MS

TABLE I (Continued)

SOURCE	RIVER DISCHARGED TO	PROCESS WASTE	WATER USED (000 gpd) Sanitary	Process	Other	SANITARY WASTE Treat./Disch. To		INDUSTRIAL WASTE Treat./Disch. To	
Meriden & Wallingford Sand & Stone	Ground	Silt	0.09	144.0	NA	C_s	Ground	C	Ground
P.B. Mutrie Motor Trans.	Quinnipiac River	Washwater	x	x	NA		MS	x	x
Revere Corp. of America	Quinnipiac River	Acids, Cleaners Cooling	5.24	20.97	63.78	C_sI_u	Ground	None	Stream
Goldfeder Silver Co.	Quinnipiac River	Nickel, Silver Cyanide, Copper Detergent, Acid Glycerine	0.75	3.47	NA	C_sI_u	Ground	None	Ground
Times Wire & Cable Co. (Sub. Intl. Silver Co.)	Quinnipiac River	Cleaner, Silver Sulfuric Acid Potassium Cyanide	1.65	27.85	103.5		MS	11	MS
Yalesville Silver Company	Ground	Silver, Cyanide Alkalai	0.12	1.32	0.63	C_sI_u	Ground	None	Ground
Wallingford S.T.P.	Quinnipiac River	Wastewater	1750			Secondary	Stream		

APPENDIX B

Water Quality Standards--Classification, Present Condition, Water Quality Parameters and Criteria, Applicable Implementation Schedules

The present water quality standards prepared by the State of Connecticut in compliance with the Federal Water Quality Act, as amended, and approved by the Secretary of the Interior, provide, in part, for specific classifications for the waters of New Haven Harbor and its tributaries. In addition, the standards include both parameters and criteria necessary to attain such classification and a time schedule for implementation by municipalities and industries. These classifications are shown on the map at the end of this report and are further described in Table 2. This table also indicates the present condition, in terms of classification, for these waters as depicted by the State of Connecticut in 1970. The parameters and criteria associated with the classifications shown are included in this appendix following Table 2. The status of implementation time tables for municipal water pollution control facilities in New Haven and West Haven are shown below:

TABLE 2

COMPARISON OF WATER QUALITY

PRESENT CONDITION VS. APPROVED STANDARDS

STREAM	PRESENT* CONDITION	APPROVED WATER QUALITY STANDARD CLASSIFICATION
Quinnipiac River		
(source to tidewater	C & D	B
(tidewater to mouth	SD	SC
Whitney Lake	-	A
Mill River (outlet of Lake Whitney to State Street)	C	B
West River (Route 80 to tidewater)	A	A
New Haven Harbor (inside line extending from Morse Park to Lighthouse Point)	SD	SC
New Haven Harbor (between line extending from Morse Park to Lighthouse Point and New Haven Shellfish Closure Line)	SC	SB
Long Island Sound (beyond Shellfish Closure Line)	SA	SA

*Expressed in terms of classification, based on data contained in Water Quality Standards, Water Resources Commission, State of Connecticut, 1970.

Municipality	Action Accomplished	Compliance Date in Federally Approved Standards	Compliance Date as Revised by State of Connecticut
New Haven -- includes	Preliminary Plan	7/68	(Complete)
	Final Plan	12/69	2/71
Boulevard Plant	Financing	5/70	6/71
East St. Plant	Start Construction	11/70	12/71
East Shore Plant*	Start Operation	11/72	12/74
West Haven --	Preliminary Plan	12/67	(Complete)
	Final Plan	12/68	(Complete)
	Financing	2/69	(Complete)
	Start Construction	8/69	2/71
	Start Operation	6/70	2/73

*Includes wastes from East Haven.

In general, the same pattern of delay applies to industrial waste sources, particularly since many of these are tied in or will be connected to the municipal sewerage system. Those industries that are known to have completed treatment facilities have been adjusted in Table 1.

STATE OF CONNECTICUT

WATER RESOURCES COMMISSION

STATE OFFICE BUILDING • HARTFORD, CONNECTICUT 06115

WATER QUALITY CRITERIA

GENERAL POLICY

1. Water quality standards adopted on the basis of these criteria are in accord with all the requirements of Section 25-54e of the 1957 Supplement to the General Statutes.

2. In the discharge of waste treatment plant effluent and cooling waters to the receiving waters, cognizance shall be given both in time and distance to allow for mixing of effluent and stream. Such distances required for complete mixing shall not affect the water usage Class adopted but shall be defined and controlled by the Commission.

3. Recommendations on other waste parameters will constitute a portion of the continuing effort of the Commission in further defining interstate and intrastate water quality standards. The Commission reserves the right to amend or extend the following criteria as improved standard methods are developed or revisions consistent with the enhancement of water quality are justified.

4. Coastal and marine waters are those generally subject to the rise and fall of the tide.

5. Interstate waters whose existing quality is better than the established standards as of the date which such standards become effective will be maintained at their existing high quality. These and other interstate waters of the State will not be lowered in quality unless and until it has been affirmatively demonstrated to the Commission and the Department of the Interior that such change is justifiable as a result of necessary economic or social development and will not interfere with or become injurious to any assigned uses made of, or presently possible in, such waters. This will require that any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required, if provided a permit, as part of the initial project design, to provide the highest and best degree of waste treatment available under existing technology, and, since for interstate waters these are also Federal standards, these waste treatment requirements will be developed cooperatively.

INLAND WATERS

CLASS A

Suitable for water supply and all other water uses; character uniformly excellent. (See note 9)

1. Dissolved oxygen	75% saturation, 16 hours/day; 5 mg/l at any time
2. Sludge deposits - solid refuse - floating solids, oils, and grease - scum	None allowable
3. Color and turbidity	None other than of natural origin
4. Coliform bacteria per 100 ml	Not to exceed a median of 100 nor more than 500 in more than 10% of samples collected
5. Taste and odor	None other than of natural origin
6. pH	As naturally occurs
7. Allowable temperature increase	None other than of natural origin
8. Chemical constituents	(See Note 4)

CLASS B

Suitable for bathing, other recreational purposes, agricultural uses, certain industrial processes and cooling; excellent fish and wild life habitat; good aesthetic value; acceptable for public water supply with appropriate treatment.

1. Dissolved oxygen	75% saturation, 16 hours/day; 5 mg/l at any time
2. Sludge deposits - solid refuse - floating solids, oils, and grease - scum	None (See Note 6)
3. Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this Class
4. Coliform bacteria per 100 ml	Not to exceed a median of 1000 nor more than 2400 in more than 20% of samples collected
5. Taste and odor	None in such concentrations that would impair any usages specifically assigned to this Class nor cause taste and odor in edible fish

CLASS B - continued

6.	pH	6.5 - 8.0
7.	Allowable temperature increase	None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85° F, or in any case raise the normal temperature of the receiving water more than 4°F
8.	Chemical constituents	(See Note 4)

CLASS C

Suitable for fish and wildlife habitat, recreational boating, and certain industrial processes and cooling; under some conditions acceptable for public water supply with appropriate treatment; good aesthetic value.

1.	Dissolved oxygen	Not less than 5 mg/l for more than 6 hours during any 24-hour period, at no time less than 4 mg/l. For cold water fishery, Cc, not less than 5 mg/l at any time.
2.	Sludge deposits - solid refuse - floating solids, oils, and grease - scum	None (See Note 6)
3.	Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this Class.
4.	Coliform bacteria per 100 ml	Not to exceed an average in any 30-day period of 5000 nor exceed this value in more than 20% of the samples collected during the period.
5.	Taste and odor	None in such concentrations that would impair any usages specifically assigned to this Class nor cause taste and odor in edible fish
6.	pH	6.0 - 8.5
7.	Allowable temperature increase	None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85° F or in any case raise the normal temperature of the receiving water more than 4° F
8.	Chemical constituents	(See Note 4)

CLASS D

Suitable for navigation, power, certain industrial processes and cooling, and migration of fish; good aesthetic value.

1.	Dissolved oxygen	A minimum of 2 mg/l at any time
2.	Sludge deposits - solid refuse - floating solids, oils, and grease - scum	None (See Note 6)
3.	Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this Class
4.	Coliform bacteria per 100 ml	None in such concentrations that would impair any usages specifically assigned to this Class
5.	Taste and odor	None in such concentrations that would impair any usages specifically assigned to this Class
6.	pH	6.0 - 9.0
7.	Allowable temperature increase	None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85° F or in any case raise the normal temperature of the receiving water more than 4° F
8.	Chemical constituents	(See Note 4)

COASTAL AND MARINE WATERS

CLASS SA

Suitable for all sea water uses including shellfish harvesting for direct human consumption (approved shellfish areas), bathing, and other water contact sports.

1.	Dissolved oxygen	Not less than 6.0 mg/l at any time
2.	Sludge deposits - solid refuse - floating solids, oils, and greese - scum	None allowable
3.	Color and turbidity	None in such concentrations that will impair any usages specifically assigned to this Class
4.	Coliform bacteria per 100 ml	Not to exceed a median MPN of 70 and not more than 10% of the samples shall ordinarily exceed an MPN of 230 for a 5-tube decimal dilution or 330 for a 3-tube decimal dilution (See Note S.5)
5.	Odor	None allowable
6	pH	6.8 - 8.5
7.	Allowable temperature increase	None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85° F or in any case raise the normal temperature of the receiving water more than 4° F
8.	Chemical constituents	None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the waters for any other uses.
9.	Radioactivity	(See Note S.6)

NOTES

1. These criteria do not apply to conditions brought about by natural causes.

2. Class D waters will be assigned only where a higher water use Class cannot be attained after all appropriate waste treatment methods are utilized.

3. All sewage treatment plant effluents shall receive disinfection before discharge to the watercourse. The degree of treatment and disinfection shall be as required by the State.

4. Waters shall be free from chemical constituents in concentrations or combinations which would be harmful to human, animal, or aquatic life for the appropriate, most sensitive and governing water class use. In areas where fisheries are the governing considerations and approved limits have not been established, bioassays shall be performed as required by the appropriate agencies. For public drinking water supplies the raw water sources must be of such a quality that United States Public Health Service limits, or State limits if more stringent, for finished water can be met after conventional water treatment.

5. Radioactivity limits to be approved by the appropriate State agency with consideration of possible adverse effects in downstream waters from discharge of radioactive wastes; limits in a particular watershed to be resolved when necessary after consultation between appropriate State and Federal agencies. In no case shall the Alpha emitters exceed a concentration of 3 picocuries per liter or the Gross Beta emitters exceed a concentration of 1000 picocuries per liter.

6. Sludge deposits, floating solids, oils, grease and scum shall not be allowed except for such small amounts that may result from the discharge of appropriately treated sewage or industrial waste effluents.

7. The minimum average daily flow for seven consecutive days that can be expected to occur once in ten years shall be the minimum flow to which the standards apply.

8. Class B and C waters shall be substantially free of pollutants that: a) unduly affect the composition of bottom fauna; b) unduly affect the physical or chemical nature of the bottom; c) interfere with the propagation of fish.

9. Class A waters reserved for water supply may be subject to restricted use by State and Local regulation.

10. All interstate Class A waters and all interstate Class B waters, except Shetucket River from confluence of Willimantic and Natchaug Rivers to Greenville Dam, Norwich, are considered to be suitable for cold water fish spawning and growth.

11. The criteria for dissolved oxygen and allowable temperature increase for interstate Class B and Cc waters are applicable to waters used only for fish passage. When such class waters are suitable for cold water fish spawning and growth, these criteria shall be the same as those specified for Class A waters.
12. In the case of interstate Class B and Cc waters where parts of such waters are not suitable for spawning and growth, the requirements for fish passage shall be considered with other sensitive uses in defining allowable temperature increases.

CLASS SB

Suitable for bathing, other recreational purposes, industrial cooling and shellfish harvesting for human consumption after depuration; excellent fish and wildlife habitat; good aesthetic value.

1.	Dissolved oxygen	Not less than 5.0 mg/l at any time
2.	Sludge deposits - solid refuse - floating solids, oils and grease - scum	None except that amount that may result from the discharge from a waste treatment facility providing appropriate treatment
3.	Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this Class
4.	Coliform bacteria per 100 ml	Not to exceed a median value of 700 and not more than 2300 in more than 10% of the samples (See Note S.5)
5.	Taste and odor	None in such concentrations that would impair any usages specifically assigned to this Class and none that would cause taste and odor in edible fish or shellfish
6.	pH	6.8 - 8.5
7.	Allowable temperature increase	None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85° F or in any case raise the normal temperature of the receiving water more than 4° F.
8.	Chemical constituents	None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, or impair the water for any other usage assigned to this Class
9.	Radioactivity	(See Note S.6)

CLASS SC

Suitable fish, shellfish and wildlife habitat; suitable for recreational boating and industrial cooling, good aesthetic value.

1. Dissolved oxygen	Not less than 5 mg/l for more than 6 hours during any 24-hour period and at no time less than 4 mg/l. For cold water fishery, SCc, not less than 5 mg/l at any time
2. Sludge deposits - solid refuse - floating solids, oils and grease - scum	None except that amount that may result from the discharge from a waste treatment facility providing appropriate treatment
3. Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this Class
4. Coliform bacteria per 100 ml	Not to exceed an average in any 30-day period of 5000 nor exceed this value in more than 20% of the samples collected during the period.
5. Taste and odor	None in such concentrations that would impair any usages specifically assigned to this Class and none that would cause taste and odor in edible fish or shellfish
6. pH	6.5 - 8.5
7. Allowable temperature increase	None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85° F or in any case raise the normal temperature of the receiving water more than 4° F
8. Chemical constituents	None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, or impair the water for any other usage assigned to this Class
9. Radioactivity	(See Note S.6)

CLASS SD

Suitable for navigation, power, and certain industrial cooling water; migration of fish; good aesthetic value.

1. Dissolved oxygen	Not less than 2 mg/l at any time
2. Sludge deposits - solid refuse - floating solids, oils and grease - scum	None except that amount that may result from the discharge from a waste treatment facility providing appropriate treatment
3. Color and turbidity	None in such concentrations that would impair any usages specifically assigned to this Class
4. Coliform bacteria	None in such concentrations that would impair any usages specifically assigned to this Class
5. Taste and odor	None in such concentrations that would impair any usages specifically assigned to this Class and none that would cause taste and odor in edible fish or shellfish
6. pH	6.5 - 8.5
7. Allowable temperature increase	None except where the increase will not exceed the recommended limit on the most sensitive receiving water use and in no case exceed 85° F or in any case raise the normal temperature of the receiving water more than 4° F
8. Chemical constituents	None in concentrations or combinations which would be harmful to human, animal, or aquatic life or which would make the waters unsafe or unsuitable for fish or shellfish or their propagation, impair the palatability of same, or impair the water for any other usage
9. Radioactivity	(See Note S.6)

NOTES

S.1 All sewage treatment plant effluents shall receive disinfection before discharge to coastal and marine waters. The degree of treatment and disinfection shall be as required by the State.

S.2 These criteria do not apply to conditions brought about by natural causes.

S.3 The waters shall be substantially free of pollutants that will: a) unduly affect the composition of bottom fauna, b) unduly affect the physical or chemical nature of the bottom; c) interfere with the propagation of fish.

S.4 These criteria shall apply at all times in coastal and marine waters.

S.5 Surveys to determine coliform concentrations shall include those areas most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions.

S.6 The discharge of radioactive materials in concentrations or combinations which would be harmful to human, animal or aquatic life shall not be allowed. In no case shall the Alpha emitters exceed a concentration of 3 picocuries per liter or the Gross Beta emitters exceed a concentration of 1000 picocuries per liter.

S.7 All interstate Class SA waters and all interstate Class SB waters, except Housatonic River from Derby Dam to mouth, Connecticut River from Hurd State Park in East Hampton to mouth, and Shetucket and Thames Rivers from Greenville Dam, Norwich, to mouth, are considered to be suitable for cold water fish spawning and growth.

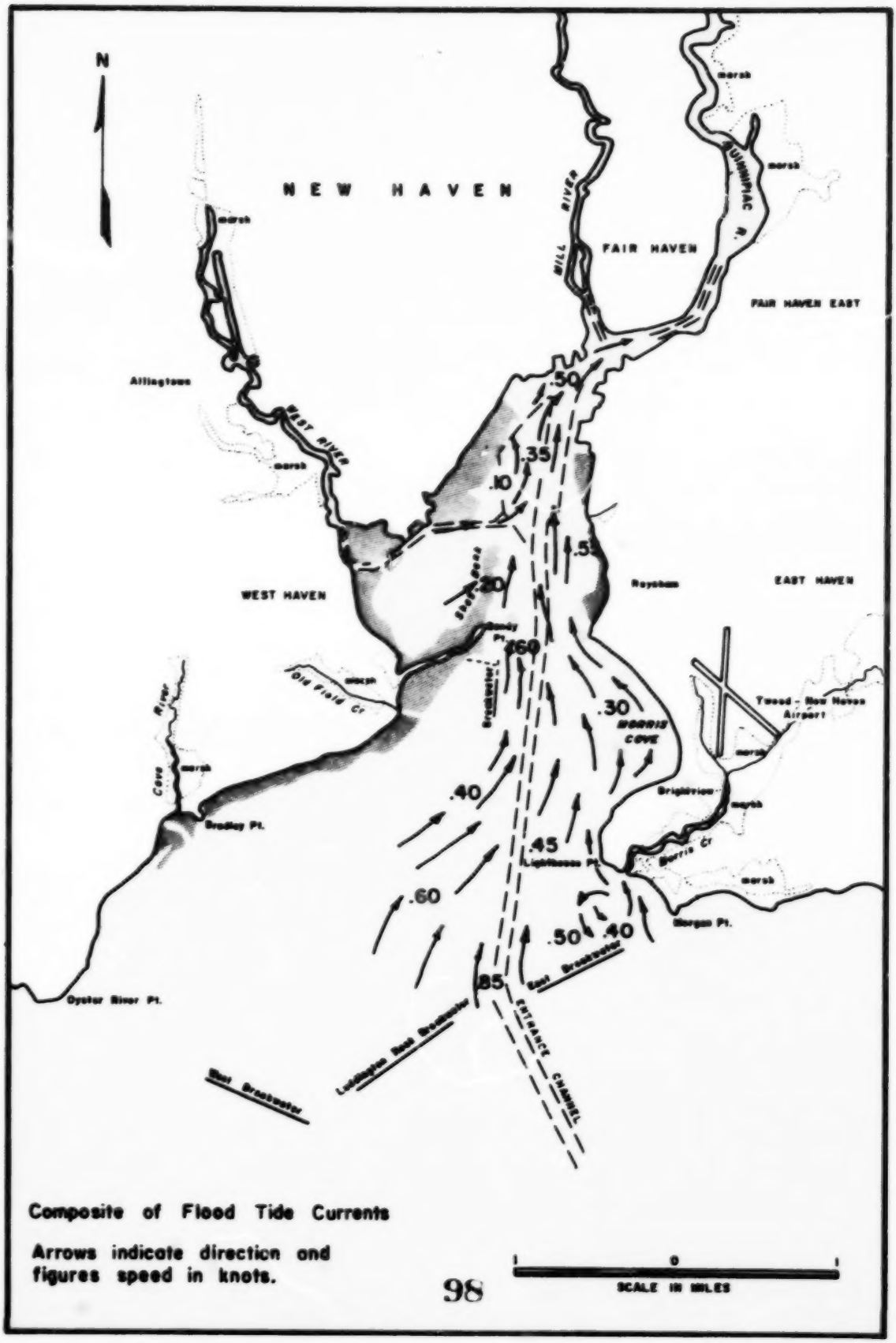
S.8 The criteria for dissolved oxygen and allowable temperature increase for interstate Class SB and SCc waters are applicable to waters used only for fish passage. When such waters are suitable for cold water fish spawning and growth, these criteria shall be the same as those specified for Class SA waters.

S.9 In the case of interstate Class SB and SCc waters where parts of such waters are not suitable for spawning and growth, the requirements for fish passage shall be considered with other sensitive uses in defining allowable temperature increases.

APPENDIX C

Current Data

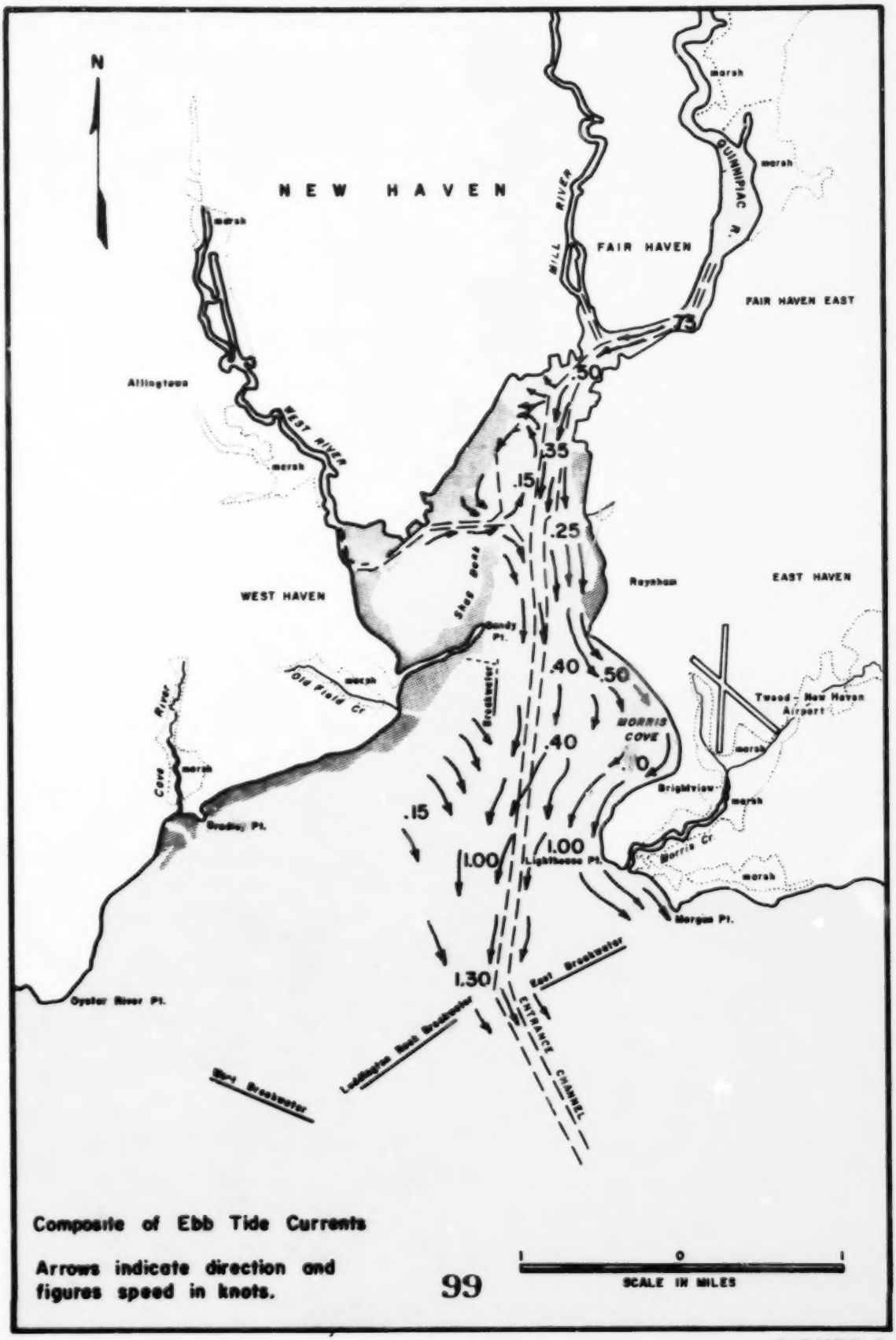
Figures 2 and 3 obtained from the U. S. Coast and Geodetic Survey indicate the speed and direction of currents in New Haven Harbor. These limited data and observations made during the field study indicate that large areas of the harbor are relatively shallow and receive minimal tidal current action. Consequently, there appears to be considerable sludge deposition in large areas of the harbor. This conclusion is also borne out in the results of the biological survey conducted during the study.



Composite of Flood Tide Currents

Arrows indicate direction and figures speed in knots.

FIGURE 2



Composite of Ebb Tide Currents

Arrows indicate direction and figures speed in knots.

FIGURE 3

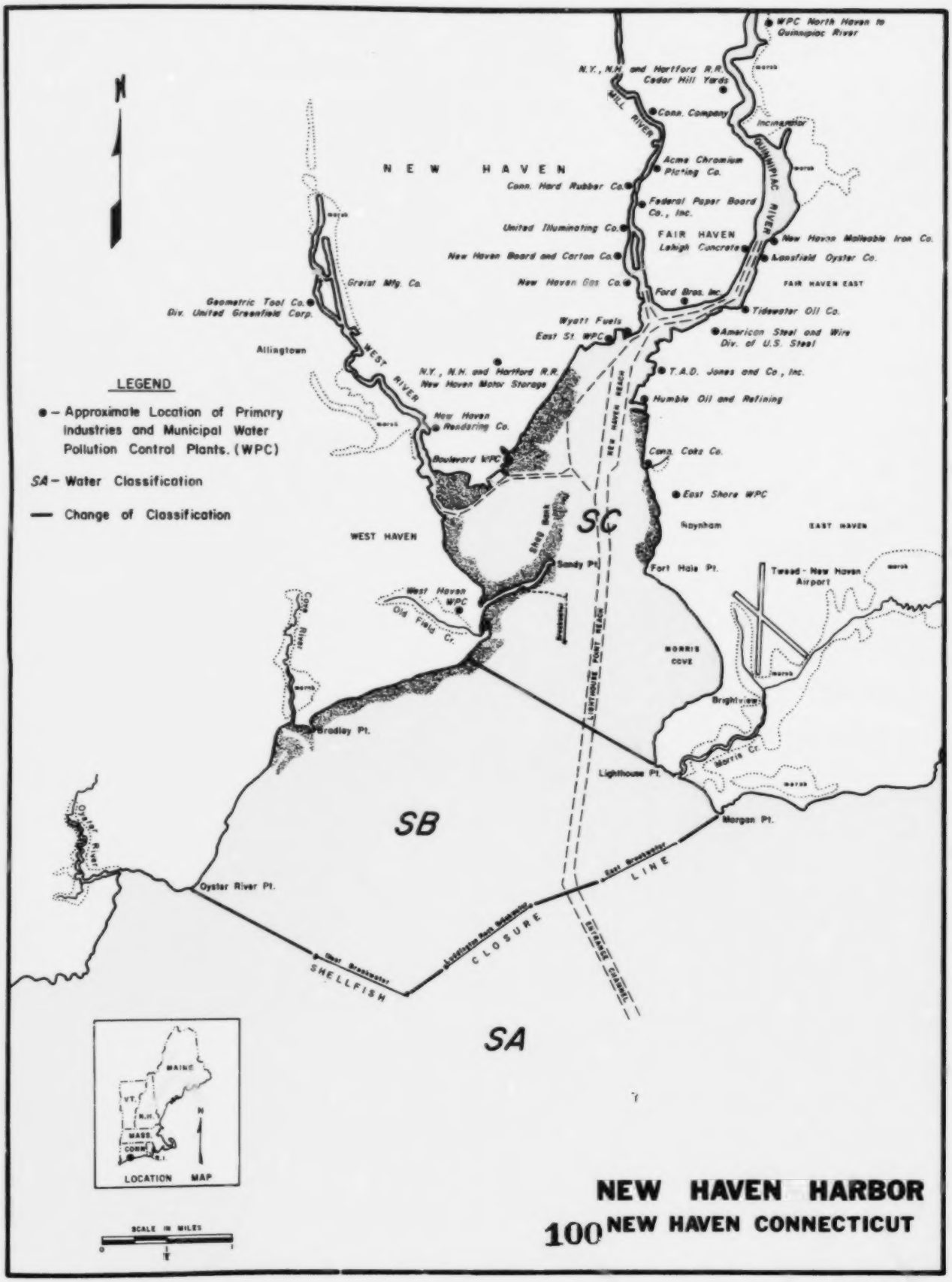

N
LEGEND
● – Approximate Location of Primary Industries and Municipal Water Pollution Control Plants. (WPC)
SA – Water Classification
— Change of Classification
WPC North Haven to Quinnipiac River
N.Y., N.H. and Hartford R.R. Cedar Hill Yards
Conn. Company
Incinerator
MILL RIVER
QUINNIPIAC RIVER
NEW HAVEN
Acme Chromium Plating Co.
Conn. Hard Rubber Co.
Federal Paper Board Co., Inc.
United Illuminating Co.
FAIR HAVEN
Lehigh Concrete
New Haven Malleable Iron Co.
New Haven Board and Carton Co.
Mansfield Oyster Co.
Greist Mfg. Co.
New Haven Gas Co.
Ford Bros. Inc.
FAIR HAVEN EAST
Geometric Tool Co. Div. United Greenfield Corp.
Tidewater Oil Co.
Wyatt Fuels
East St. WPC
American Steel and Wire Div. of U.S. Steel
Allingtown
WEST RIVER
N.Y., N.H. and Hartford R.R. New Haven Motor Storage
T.A.D. Jones and Co., Inc.
Humble Oil and Refining
New Haven Rendering Co.
NEW HAVEN HARBOR
Boulevard WPC
Conn. Coke Co.
East Shore WPC
SC
WEST HAVEN
Sand Bank
Sandy Pt.
Fort Hale Pt.
Tweed - New Haven Airport
West Haven WPC
Old Field Cr.
Cove River
MORRIS COVE
Brightview
Bradley Pt.
Morris Cr.
Lighthouse Pt.
SB
Morgan Pt.
Oyster River
Oyster River Pt.
East Breakwater
LINE
West Breakwater
Anchorage Basin Extension
CLOSURE
SHELLFISH
Entrance Channel
SA
MAINE
VT.
N.H.
MASS.
CONN.
R.I.
LOCATION MAP
SCALE IN MILES
0
1
NEW HAVEN HARBOR
100 NEW HAVEN CONNECTICUT

FIGURE 1